ELECTRICAL REVIEW

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19 MARCH 1954

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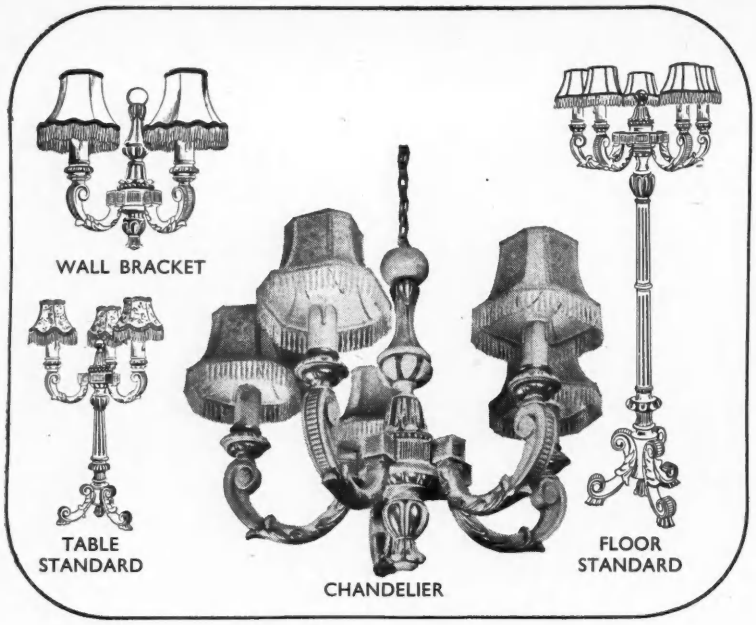

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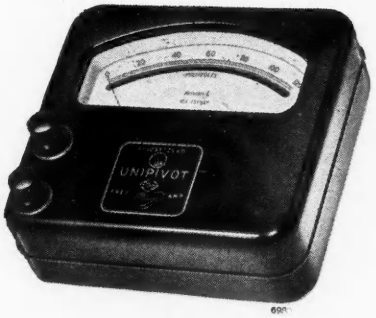

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ELECTRICAL REVIEW

19 March 1954 Vol. 154 No. 12 Established 1872

Electricians' Wages

ALTHOUGH the strikes in the electrical contracting industry which had been going on for about two months were not such as to create a national crisis their effects were serious enough. In many (perhaps most) general building contracts the electrical sub-contractors' work is essential both as regards the constructional operations and the actual electrical installations. As this work enters into the earlier stages any stoppage holds up a number of other tradesmen engaged in a contract. Thus the strikes have occasioned delay and caused losses to many firms outside the electrical contracting industry.

Little good can be done by repeating the sad story of this dispute but it should be said that, although at the outset both the Electrical Trades Union and the National Federated Electrical Association adopted stiff attitudes towards one another, the continuance of the strikes was wholly the responsibility of the E.T.U. The N.F.E.A. persisted with its offer to submit the question to arbitration, and "reported" the dispute to the Minister of Labour, but the Union resorted to ambivalence: it did not flatly reject arbitration, but sought to lay down conditions which it knew the N.F.E.A. would not accept.

We suppose that the E.T.U. will regard the employers' concession of a 2d an hour increase as a victory. In a sense it is for it seems that the Union has forced the N.F.E.A. to go against its earlier decision that no increase was justified. It will inevitably be said that the increase could have been granted in the first place: the N.F.E.A. had actually offered at an earlier stage a rise of 1½d an hour, but to this was attached a provision that overtime payments should be reduced. The employers' answer to this is that their decision was made in the light of the report of the Court of Inquiry into the engineering wages dispute whose conclusions and recommendations were relevant to other industries. It will be recalled that this Court of Inquiry recommended an increase of 5 per cent as a basis of discussion; the increase in the electrical contracting industry ranges, in the three zones, from 4·1 to 4·65 per cent. As the general engineering industry has been brought into the picture it is perhaps worth noting that the minimum consolidated 44-hour week time rate for a skilled fitter is 3s 1·18d an hour. The Court of Inquiry pointed out, however, that the majority of time workers receive some additional payments by way of merit rates, compensatory rates, lieu rates (where payment by results is impracticable) or bonuses of other kinds. The minimum standard for a skilled fitter on piecework is 147s 1d for a 44-hour week, i.e., 3s 4d an hour. The increase now granted to electrical contractors' employees raises the journeyman's hourly rate to 4s 2d in London, 3s 10d in the Merseyside District and 3s 9d in "Grade B" areas.

Possibly these comparisons are not exact but there certainly seems to be a substantial margin between electricians' rates and those of skilled fitters. Probably the technical knowledge and skill of the electricians justifies this difference but we think that they have done well to secure the present increase. The case for even higher wages (a further demand has already been made) will have to be fully proved, if not to the employers then to an independent arbitrator.

FLUE GAS WASHING

While emissions from power station chimneys add very little to general atmospheric pollution, great expenditure has been incurred in attempts to eliminate them. Modern grit extractors are giving excellent results, but the washing of flue gases (at great expense, both capital and maintenance) at a few stations to remove sulphur products has been unsuccessful. Indeed Sir Herbert Williams, in a House of Commons debate last week, did not overstate the position in suggesting that gas washing only aggravated the problem. Technically efficient as the processes are, there is still a sulphurous residue, which is cooled to a temperature little in excess of the surrounding air so that under not uncommon weather conditions it descends to earth locally. On the other hand if unwashed hot gases are discharged from tall chimneys (usually over 300ft high), their velocity causes them to reach upper wind currents by which they are harmlessly dispersed.

MACHINE DRIVING METHODS

Our recent reference to the electrogyro locomotive with its large storage flywheel incorporated in a s.c. motor prompts us to call attention again to the fact that fairly frequently one still hears engineers refer to the Ilgner set as a Ward-Leonard control driving unit embracing a flywheel. This is a pity because it detracts from the real meaning both of Ward-Leonard control—armature voltage and hence speed control of the driving motor by field regulation of the supply generator—and of the Ilgner principle—a purely mechanical (flywheel effect) means of taking the extreme peaks of heavy machinery like steel rolling mills and rubber mixing equipments off the driving motors. It is true that one often sees the Ward-Leonard control m.g. set incorporating an Ilgner flywheel, and an excellent combination it makes for many cases of driving and control, but the two types of equipment are probably more often seen running separately and independently, and it is important that there should be no confusion over the uses of these distinct contributions to electrical driving.

A LONG RECORD

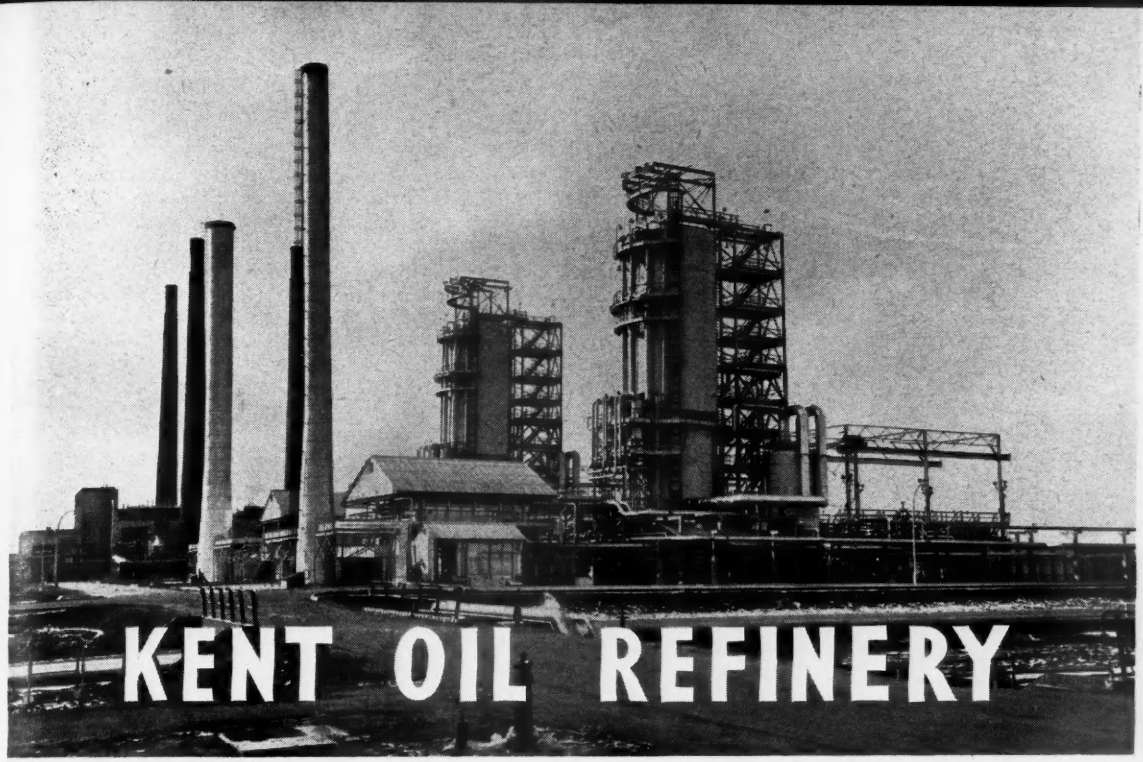
For one learned society to follow closely in its *Transactions* the electrical and allied developments over as long a period as 200 years is surely a record. The Royal Society of Arts will celebrate the two-hundredth anniversary of its foundation in a few days' time. In an article in this issue outlining the activities of the Society over this long period is mentioned the award by the Society in 1825 of a silver medal and thirty guineas to W. Sturgeon for an "improved electro-magnetic apparatus," while at the other extreme in respect of time it is only a few months since we read in the Society's journal the paper presented before the Society by Mr. F. L. Lawton, chief engineer, Power Department, Aluminium Laboratories, Ltd., describing the construction of what is probably the world's second largest and most modern hydro-electric development, the Nechako-Kemano scheme of the Aluminum Company of Canada, Ltd., which we intend to describe next week. Between these two events, each great in relation to its time, almost every outstanding development in electrical science and engineering has been marked by the Society's proceedings, e.g., Faraday's discovery in 1831, Smee's galvanic battery in 1840, the Swan and Edison lighting developments around the 1870's, the Siemens and Crompton dynamos, the Graham Bell telephone about ten years later, Marconi's "wireless" earlier this century, and electric traction, to name but a selected few. Incidentally, the reminder about Sturgeon's "improved electro-magnetic apparatus" should dispel the idea that Faraday was the first to introduce an electro-magnetic device, although he was, of course, the first to realize its great value.

PRECISION AND SERVO-MECHANISM

The extraordinary precision which can be afforded by means of the servo-mechanism for almost any requirement—voltage, speed, temperature, position, direction, torque, etc., is ever increasingly being brought to our notice. One example of this is the two papers, "The Minimum-Moment-Of-Error-Squared Criterion: A New Performance Criterion for Servo-Mechanisms," by Dr. J. H. Westcott, and "The Behaviour of a Remote-Position-Control Servo-Mechanism with Hard-Spring Non-Linear Characteristics," by Dr. J. C. West, B.Sc., and Mr. P. N. Nikiforuk, B.Sc., both presenting particular aspects of the subject, which were read before the Institution of Electrical Engineers this week and to which we refer elsewhere in this issue. Another example is the reference which was made by Field Marshal Earl Alexander of Tunis in his speech as guest of honour at the recent annual dinner of the Institution of Electrical Engineers (*vide Electrical Review*, 5th March) to the gun of the "Centurion" tank which, once it is trained on the target, can be held there no matter how rough the ground. This is effected by a servo-mechanism with modern methods of electronic transmission from the error detecting device to the error correcting device.

GAS BOARD'S CLAIM

What is termed a revolutionary method of making gas has been announced by the North Western Gas Board which has been experimenting with the system for the past two years. It is claimed that by injecting gas into the base of a standard vertical retort a remarkable increase in the speed of gas production has been achieved; indeed it is said that the carbonization time has been halved and, moreover, it is possible to use coal slack for the purpose. If these claims are substantiated and the method is proved generally practicable it means that the electricity supply industry will have no monopoly in the use of the inferior fuel which it now consumes to so large an extent. Also the price of gas would be very considerably reduced, thus strengthening gas competition with electricity. It is to be hoped, however, that this possible way of eking out our diminishing coal resources will not interfere with the progress of atomic power development.



KENT OIL REFINERY

Third Stage of Isle of Grain Scheme Nears Completion

ALTHOUGH the construction began as recently as September, 1950, the first three stages of the Anglo-Iranian Oil Company's scheme for establishing an oil refinery at the Isle of Grain are now practically complete, in the face of severe handicaps in the way of last year's heavy flooding and also the electricians' strikes. Designed to serve the South East of England as well as the Continent, the refinery covers about half of a 1,600 acre site acquired by the company, about 90 per cent being "marginal" land so as not to interfere with agriculture.

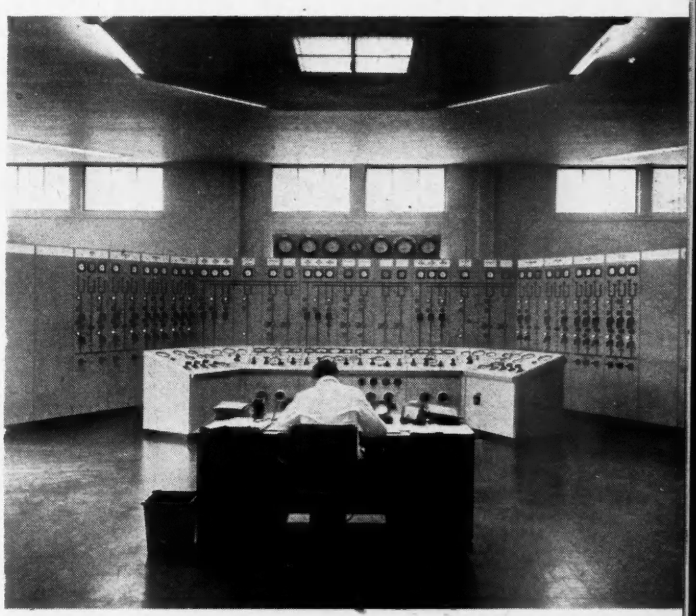
Four million tons per annum of Middle East crude oil will be processed and the principal products will be motor spirit (764,000 tons a year), premium grade kerosene (264,000 tons), tractor vaporizing oil (72,000 tons), gas oil (478,000 tons), fuel oils (1,822,000 tons), and lubricating oils (138,000 tons). The first stage of the scheme comprising the crude oil distillation plant and necessary auxiliary plants for the "sweetening" and blending of the chief products, was completed and put into commission last February.

Catalytic cracking and vacuum distillation plant for converting the heavier types of semi-refined oils into high grade motor spirit together with an SO_2 treatment plant for the purification of kerosene, made up Stage 2 which was put into service towards the end of last year. A second vacuum distillation unit with four lubricating oil plants is well advanced and the third stage should be completed by the late spring, except for a lubricating oil blending and packaging plant not due to be in service until the autumn. The provision of a platformer involving the use of platinum catalysts for producing high grade spirit is among projects now in course of construction.

Initially at any rate the refinery will rely on the South Eastern Electricity Board for its electricity, receiving supplies through two B.E.T. 7·5 MW 33/11 kV transformers. In view, however, of the large quantities of steam required for process work (when the third stage is complete it is estimated that over 600,000 lb/hr will be needed) four English Electric back-pressure turbines coupled to 11 kV generators have been installed to supply a large proportion of the power requirements of the refinery. If need be these generators could carry the whole load.

Two of the alternators have outputs of 5 MW each and two of 3 MW each. The former run at 1,000 r.p.m. and the latter at 1,500 r.p.m., the turbine speed being reduced by gearing from 5,970 r.p.m. One set of each size operates with a back pressure of 250 lb/sq in and the other two at 175 lb/sq in. The steam conditions at the turbine are

Above: The two vacuum distillation units with the power station on the left. Below: The central power house control room



indicated on a Kent instrument panel in the turbine room and are repeated on the main control desk. Two auxiliary oil pumps are provided for each main set, one on a.c. supply and the other on d.c. from battery supply.

Steam generation facilities installed comprise five Spearing 150,000 lb/hr tri-drum boilers fitted with superheaters and economizers, with provision for a further boiler later. They operate at 575 lb/sq in pressure with a temperature of 740 deg F. In addition there are twelve single-effect evaporators each of 27,650 lb/hr capacity operating with steam at 250 lb/sq in. Steam from the boilers is " tapped " for the back-pressure turbines. Two turbines operate with a back pressure of 250 lb/sq in, thus supplying evaporator requirements and also turbine drives for the main and auxiliary cooling water pumps. The other two exhaust at 175 lb/sq in and, together with steam produced in the evaporators, serve the refinery process.

The boilers are designed for both gas and oil fuels and are equipped with automatic combustion control. Supervision of boiler operations is facilitated by indicators and recording instruments mounted on a panel sited on the firing aisle; these give all relevant boiler operating data and were supplied by Bailey Meters & Controls, Ltd.

Boiler feed water consists of condensate returned from refinery processes and cooling water pump condensers and from evaporator coils. Raw water is supplied to the evaporators after treatment in a Permutit lime soda and base exchange plant of 50,000 gal/hr capacity. This is fed to de-aerators by means of four pumps each of 200,000 lb/hr capacity, two electrically and two steam turbine driven. The evaporators are fed by five pumps, each of 200,000 lb/hr capacity, three being electrically and two steam turbine driven. The 3,300 V motors of 110 h.p. each are of Metrovick manufacture.

The boiler feed de-aerators are served by four 380,000 lb/hr lift pumps, two being electrically and two steam turbine driven. The electric units are operated by Bruce Peebles and B.T.H. 440 V 45 h.p. motors. Three of the five 270,000 lb/hr main feed pumps (Weir) are electrically driven by English Electric 3·3 kV 2,950 r.p.m. motors. Weir h.p. feed heaters are also installed. Adjacent to the water treatment plant is the main air compression plant providing service and instrument air requirements. Two of the compressors installed are steam driven and one electrically driven (by a Metrovick 600 b.h.p. motor).

Four steam turbine driven pumps with a total installed capacity of 6 million gal/hr for the general cooling water supplies and two turbine driven pumps with a total capacity of 1·2 million gal/hr for cooling water for the main pump condensers are supplied with steam at 250 lb/sq in. The generators are protected by a Merz-Price system, with back-up over-current and instantaneous earth-fault protection, and the incoming feeders from the Electricity Board have directional over-current protection. Outgoing circuits are equipped with ITDMTL over-current and instantaneous earth-fault protection, with Buchholz 11/3·3 kV transformer protection, and intertripping.

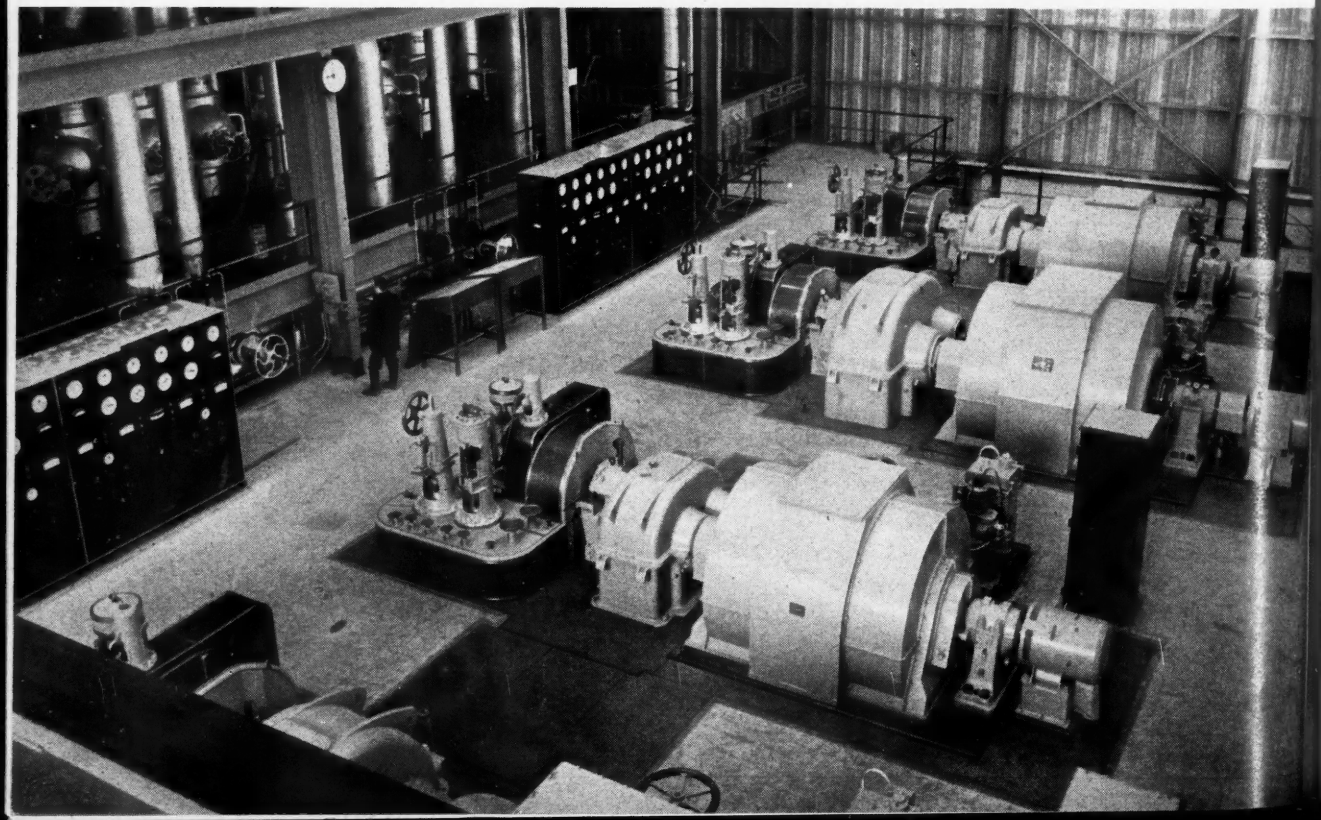
The main refinery 11 kV central switchboard (Reyrolle), accommodated in a central power control house, is in three sections and consists of 39 panels of 11 kV 250 MVA type C7T horizontal draw-out duplicate busbar switchgear, with compound filled busbar and transformer chambers and solenoid operated oil break circuit breakers. In addition, there are three Reyrolle subsidiary switchboards as follows:—

(*a*) A nine panel 11 kV 150 MVA type C5T single busbar switchboard similar in general construction to the main switchboard, for generator and transformer neutral earthing.

(*b*) An eleven panel 3·3 kV 75 MVA type LA22T single busbar vertically isolated house service switchboard in the power station with air insulated busbar and transformer chambers and solenoid operated oil break circuit breakers. This switchboard feeds auxiliary transformers, boiler feed pumps, and the evaporator plant switchboard (see item (*c*) below).

(*c*) An eight panel 3·3 kV 75 MVA type LA22T single busbar vertically isolated evaporator plant switchboard with air insulated busbar and current transformer chambers and solenoid operated oil break circuit breakers.

View of the power station turbine room showing instrument panels on the left



The main control room, also in the central power control house, is equipped with a corridor control and relay board arranged in the form of a shallow U, the control portion of which embodies a mimic diagram of connections giving a continuous picture of the 11 kV and 3·3 kV generation and main distribution switchgear systems. An additional set of desk type panels is arranged at the open end of the U, accommodating generator, transformer and neutral earthing control switches, synchronizing and remote 7·5 MVA S.E.E.B. transformer on-load tap change equipment and instruments, and a diagram indicating the steam loadings of the refinery. Two auxiliary control boards behind the desk type panels accommodate generator automatic voltage regulators, fire alarm and indication, also feeder and generator summation meters. A desk with telephone equipment and a writing table for the control engineer is arranged centrally.

The three sections of the 11 kV central switchboard are in separate switchrooms. The two alternative supplies from the Electricity Board are taken respectively to the outside sections, A and C. The four generator supplies are spread over the three sections, No. 2 feeding section A, Nos. 1 and 3 section B, and No. 4 section C. The scheme provides, if desired, for non-essential loads to be connected to one set of busbars and the essential loads to the other. In these circumstances the generators will normally run in parallel with the grid supply and in the event of a grid failure or a drop in frequency a frequency operated relay opens all bus-couplers leaving the essential load connected to the generators.

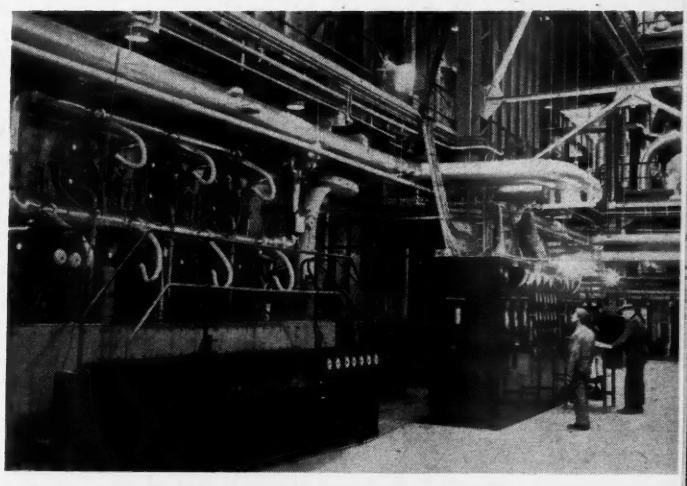
Distribution is arranged on the radial feeder principle, the 11 kV supplies being taken to the 3·3 kV power station house service switchboard through 2,500 kVA English Electric transformers and to a number of area substations that distribute to satellite substations, plant switch-houses and pumphouses. At present there are seven area substations and four satellite substations in use, but there are seven spare panels provided in the control room in readiness for additional substations when required.

Three feeds are taken from the power station to five process area substations and are directly connected to 11/3·3 kV 1,250 kVA English Electric feeder transformers. Two of these are normal supplies and the third, which serves as a stand-by, is automatically switched in if one of the normal supplies fails. The tank farm and foreshore area substations have only two feeds and two transformers but, as the design of all substations has been standardized, provision is made for the installation of an additional transformer and switchgear should conditions require it.

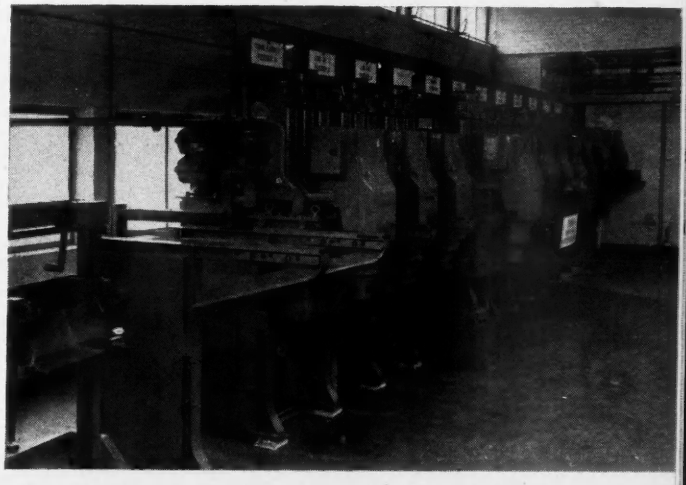
All the 3·3 kV switchgear at these substations is flameproof and of the Reyrolle 3·3 kV 25 MVA pillar type, with horizontal draw-out oil break circuit breakers with remote control and automatic switching of transformer incomers obtained by means of motor operated closing mechanisms. This 3·3 kV switchboard supplies a flameproof 400 V 5 MVA Reyrolle switchboard through two 250 kVA English Electric transformers for meeting small power, lighting and instrumentation requirements of plants and pumphouses in the associated area.

Duplicate supplies at 3·3 kV are run from the area substations to satellite substations, and to major process plants and pumphouses, the 3·3 kV switchgear at these positions being similar to that at the area substations. Some of the smaller satellite substations, however, are equipped only with 440 V 5 MVA pillar type switchgear, which is fed from the area substation through 250 kVA 3·3 kV/440 V feeder transformers.

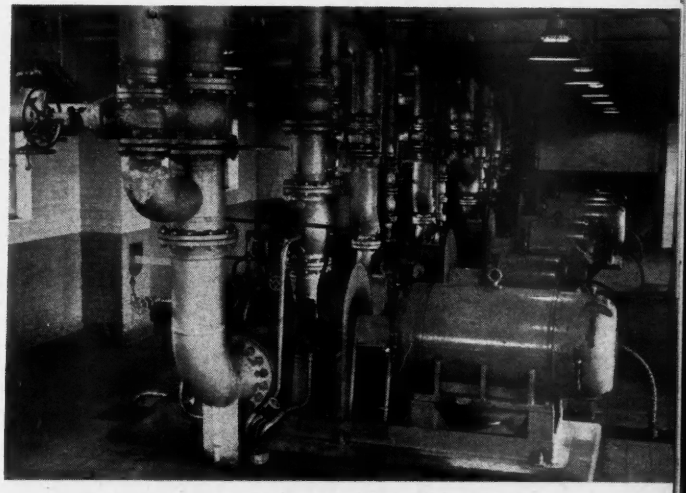
Pyrene automatic CO_2 fire protection is provided for all the main 11 kV switchboards and area and satellite substations and in the event of its coming into operation an



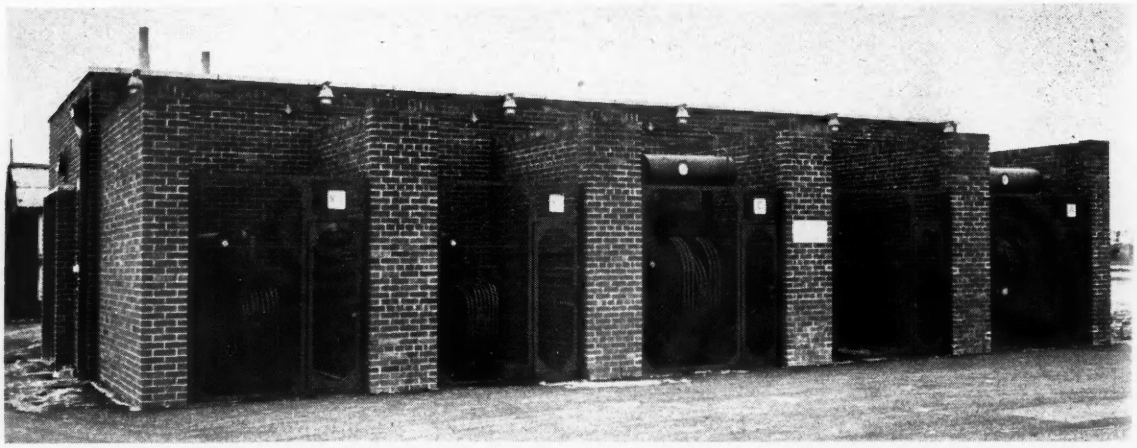
The power station boiler house with control panel on the right



One of the three sections of the power station 11 kV switchboard



The products pumphouse. Each motor is provided with its own flameproof push-button control and ammeter



Each of the area substations is equipped with two or three 11/3·3 kV 1,250 kVA and two 3·3 kV/440/250 V transformers

alarm is sounded in the control room, an illuminated indicator panel showing which substation is affected. All street lighting is remotely operated from the control room, each area substation having a flameproof E.A.C. contactor, with control pilots included in the multicore cables provided for switchgear remote control and indication.

All the 11 kV and 3·3 kV switch closing, tripping and indicating 240 V d.c. supplies are provided from a central battery room situated in the central control house. The 186 cell "Nife" battery installed there also provides emergency lighting in the power station area. In the event of failure of normal lighting and instrumentation supplies in the major process plants, emergency 50 c/s supplies are automatically obtained from 5 or 10 kW flameproof steam driven turbo-alternators (Hayward Tyler-Lancashire Dynamo).

The d.c. supplies for area substation incoming switch control and indication, etc., are taken, by means of the multicore cables already referred to, between the control room and the area substations. Lighting and heating in area and satellite substations, plants, etc., are fed from three-phase four-wire and single-phase a.c. flameproof distribution switch-fuse boards of Cantie manufacture. The quantity of equipment at the various plant switch-houses varies but major process plants have a 3·3 kV switchboard in two sections fed by duplicate supplies from the area substation and a 440 V switchboard in two sections fed by duplicate supplies through 250 kVA transformers from the plant 3·3 kV switchboard. The 3·3 kV equipment is again of horizontal draw-out pillar construction, and the 440 V switchboard consists of a composite assembly of horizontal draw-out switchgear, Reyrolle type YFA contactor equipment, and some equipment of the Electrical Apparatus Co.'s manufacture.

Throughout the refinery instrumentation has been adopted extensively. Here is the control room in the catalytic cracking plant

Standardization of the type of gear used and of the protection adopted have resulted in a large measure of interchangeability throughout the installation, and this has been helped by the adoption of standard transformer sizes.

Altogether the refinery will have an operating load of about 15,000 kW. About 500 motors are installed ranging in size from fractional h.p. to a 600 h.p. Metrovick machine already referred to for driving a Fullerton air compressor. In general all motors over 50 h.p. operate at 3·3 kV, the remainder at 440 V. There are about 550 socket outlets and 6,900 lighting points. Within the hazardous areas all the equipment is of the flameproof type. Direct-on-line motor starting, employing mostly Reyrolle gear, except for the smaller units which are E.A.C., has been employed throughout, even for the largest machine. Generally the control gear has been grouped in the switch-houses associated with each section of the plant, remote control being provided close to the actual motors by means of push-button units fitted with ammeters.

In addition to the Electro Mechanical Manufacturing Co.'s distribution boards in the power station area Cantie Switchgear, Ltd., and Walsall Conduits, Ltd., have supplied a number of flameproof multi-way switch-fuse boards in the refinery. Several flameproof switch-fuses have also been supplied by the Simplex Electric Co., Ltd., also built up into miniature multi-way switchboards. The same company has been responsible for flameproof conduit fittings, etc. Belmos industrial motor control switchgear is installed in the lubricating, oil blending and packaging plant.

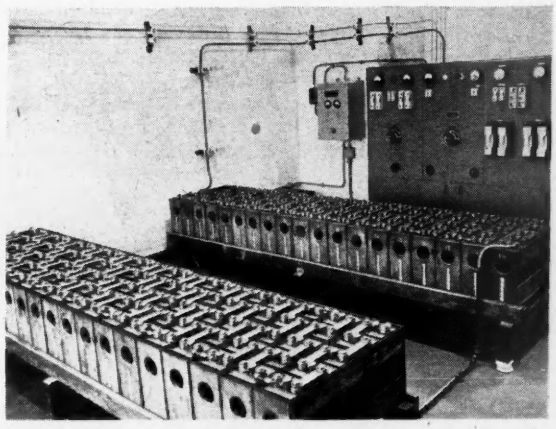
As will have already been gathered, extremely elaborate precautions have been taken to obviate any possible risk of fire in the inevitably dangerous atmospheric conditions.

Flameproof equipment has been adopted virtually everywhere in the refinery area. Also, since the refinery operates as a single integral unit, practically all plant has been duplicated to avoid hazards resulting from the shutting down of any particular section. A special example of the precautions taken is to be found at the refinery jetties. These are electrically equipped to modern standards of efficiency and safety, but as an additional safeguard there is a simple electrical device whereby, when the jetty attendant pushes an emergency button, an electrical relay is actuated and a pre-selected motor is stopped. Emergency push-buttons are provided at each jetty and under loading operations are connected to associated pump motor starters via a selector desk situated in the foreshore area.

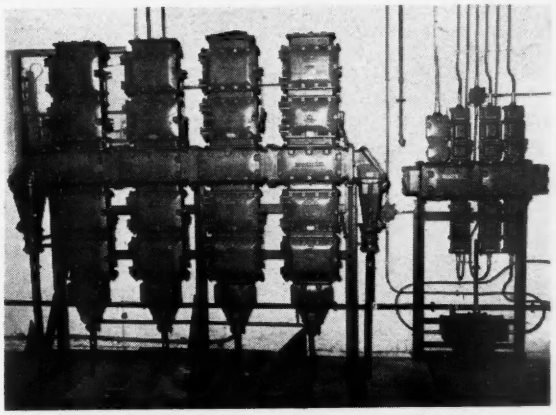
Safety interlocks are provided to ensure that pump motors, when in the "auto" position, cannot be started until the appropriate selector desk connection has been made. Under these conditions visual indication is provided at the jetties and the selector desk for "motor running" and "motor stopped." The flameproof apparatus at the jetties and on pump-house control pedestals was developed by A. Reyrolle & Co., Ltd., while the selector desk equipment has been provided and installed by the Automatic Telephone & Electric Co., Ltd.

Throughout the refinery instrumentation has been adopted extensively to supervise operations and eliminate as far as possible any risk of breakdowns which can be highly expensive as well as dangerous in the continuous and integrated processes involved. In the plant control rooms provided in the various refinery units the Foxboro', Kent, Evershed & Vignoles and Brown instruments provided show at a glance temperatures, pressures, etc.

Six special pressed steel separator tanks, each 96ft by 8oft by 10ft deep, have been constructed by Braithwaite & Co., Structural, Ltd., for the separation of oil from process water before it is returned to the River Medway. Contaminated water enters the inlet compartments and is passed into a second compartment where adjustable weir plates allow the water to spill into the four adjacent skimming compartments. Here oil is mechanically removed from the surface into retaining troughs, fixed

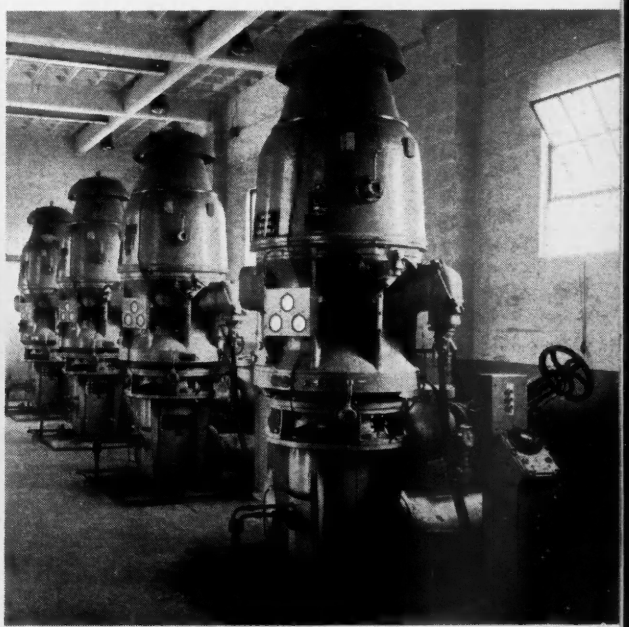


Battery room serving the switch tripping and indicating equipment



Substation switch-fuse board, the left-hand section covering the auxiliary power plant and the right-hand section the lighting

Area substation showing 3·3 kV and 440 V switchgear and (right) vertical spindle crude oil pumps driven by 360 h.p. and 125 h.p. motors



baffles deflecting any impurities that may have escaped the troughs. The skimmed water passes over further adjustable weir plates into the outlet compartment. For removing sludge from the tanks scrapers fitted to mechanical skimming gear move across the bottoms of the skimming chambers. This secondary process takes place after the skimming cycle has been completed and the mechanical skimmers are returned to their original positions.

For surface drainage purposes there are eight Gwynne pumps each with a capacity of 1,500 gal/min. These are driven by Bruce Peebles 35 h.p. motors and are controlled by an Evershed & Vignoles "No-flote" system.

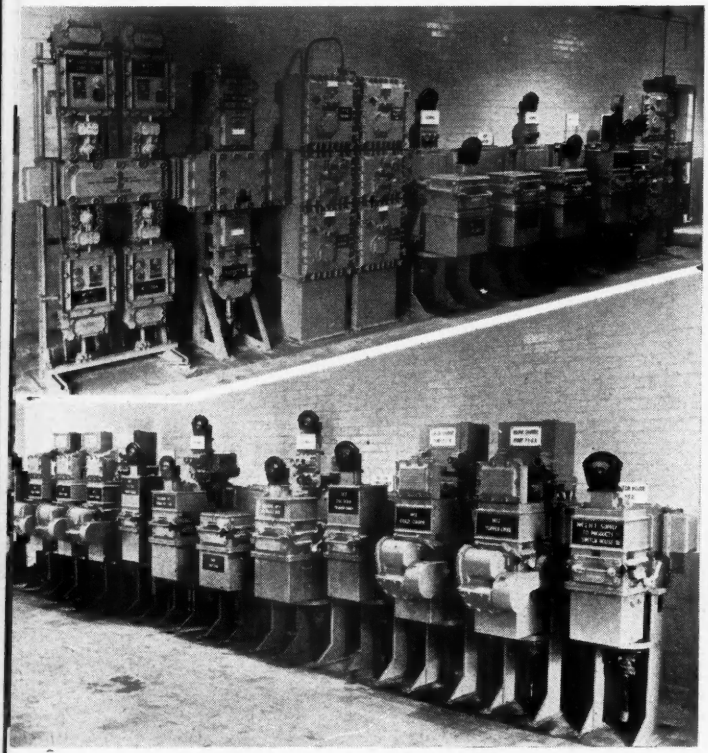
A considerable number of flameproof lighting fittings have been supplied by Holophane, Ltd., including about 400 street lighting units with 150 W, 300 W and 500 W tungsten lamps and flameproof switch-fuses in the bases of the columns. Holophane fittings are also utilized in the substations. B.T.H. fluorescent lighting equipment has been employed to good effect in the central power control room where a central "egg-crate" unit incorporating eight 5ft 80 W tubes is surrounded by an octagon of twin tube "Perspex" fittings, supplemented by twin light units recessed in the ceiling at each corner of the room.

Area substations have a measure of space heating using G.E.C. flameproof tubular heaters, while domestic hot water supplies throughout the refinery are provided by "Sadia" thermal storage heaters. A 350 line PABX automatic telephone exchange of Automatic Telephone Equipment Co. manufacture provides communication throughout the refinery and is connected with the public system.

Ewbank & Partners are acting as consulting engineers for the power utilities, and E. B. Badger, Sons & Co., Ltd., as managing agents for the project. Most of the electrical contracting work is being carried out by George Wimpey & Co., Ltd., and Matthew Hall & Co., Ltd. Johnson & Phillips are responsible for the main distribution cable work, which has involved the laying of paper and v.i.r. lead covered and armoured cables in precast concrete, sand-filled trenches in the refinery process area and direct-laid elsewhere. Pyrotenax mineral insulated cable has been employed extensively for surface installations and considerable use has also been made of served aluminium sheathed cable of Johnson & Phillips manufacture.

We are grateful to the management and staff of the Kent Oil Refinery, Ltd., for the facilities provided for inspecting the installation and also to the staff of the Anglo-Iranian Oil Co., Ltd., for the help given us in the preparation of this article.

Plant switch-house showing 440 V motor starting panels and (lower photo) 3·3 kV distribution and motor starting panels



NEW BRITISH STANDARDS

Arc Welding Plant

THE British Standards Institution has recently published a revised standard (B.S. 638 : 1954) for arc welding plant and equipment. It deals with both d.c. and a.c. equipment and includes requirements for heavy-duty multiple arc a.c. equipment for heavy constructional work, which was previously dealt with in the war emergency B.S. 1071. The basis of rating used in the two previous issues of this standard has been retained and the only major modification is the introduction of maximum hand welding current which, together with a definition of arcing time factor, should enable the user to select with greater accuracy the correct capacity of welding plant for a given duty. Provision is made for a type of single operator plant which, when operated at a lower arcing time factor than that assumed in the standard rating, can be used to supply currents in excess of the maximum continuous hand welding current. Such plant is required to be fitted with a warning plate stating the value of this maximum current.

Part 4, which deals with multiple arc transformer welding plant for heavy duty, follows closely B.S. 1071 : 1943, except that the standard open circuit secondary voltage has been reduced from 100 to 90. As a result the welding current per phase has been raised from 300 to 350 A.

In addition to the rating of welding plant the specification includes requirements for welding cables, plugs and sockets, electrode holders, return current clamps, items associated with personnel protection, and paralleling boxes and devices for use with heavy duty plant.

Three-Phase Motors

The British Standards Institution recently issued a standard dealing with the dimensions of f.h.p. motors (B.S. 2048: 1953). To fulfil further the need for dimensional standardization of electric motors in the United Kingdom, a second standard (B.S. 2083 : 1954) has now been issued. It establishes nine frame sizes for three-phase 50 c/s squirrel-cage, totally enclosed fan-cooled foot-mounted motors intended for industrial purposes and having a maximum continuous rating. The standard is applicable to motors operating at voltages not greater than 650 V and covers machines of 1 to 20 h.p. at 1,500 r.p.m. (synchronous speed).

With the exception of the 1 h.p. four-pole motor, the dimensions specified are similar to those given in the American N.E.M.A. Standard MG 1–1949, but for a given frame size the horse-power outputs have been increased to fall into line with practice in this country and shaft dimensions have been enlarged accordingly. It is recognized that there will be a considerable transition period before all motors can be supplied exactly in accordance with this standard, and mutual agreement between contracting parties as to the extent of its application may initially be necessary.

Copies are available from the British Standards Institution, British Standards House, 2, Park Street, London, W.1, price 7s 6d (B.S. 638) and 2s 6d (B.S. 2083).

The Illuminating Engineer's Status

How to Make the Best Use of His Abilities

By N. CORCORAN,
B.Sc., M.Sc.Tech., B.A.(Com.)*

THIS article is concerned with the part played by the illuminating engineer in the organization of which he is a member and the methods for using his skill to the full. This organization may exist primarily to obtain installation contracts, to sell lamps, or to sell fittings and, whatever the circumstances, there is usually an appreciable amount of business that can be carried on without any technical assistance.

Most firms have sales offices, intended for dealing with routine orders, and then station an illuminating engineer in each of the larger ones. The engineer visits sites, examines the nature of the premises or roads he is to light, and suggests the most suitable form of lighting. This is a very satisfactory solution, provided that enough inquiries are obtained to keep him busy on technical work, and provided that he really is treated as an engineer and not as a clerk who designs lighting schemes when he has nothing better to do.

Engineers and Sales Managers

The illuminating engineer in a branch office should spend some of his time in keeping up to date. This is often overlooked in an office under the control of a non-technical sales manager, and the engineer has to play a lone hand in an almost hostile environment. In some offices he is not allowed to sign his own letters; his technical suggestions are incorporated into a tender which is sent out over the signature of a sales executive, who thus appropriates the technical credit. This is not to be recommended, as customers may distrust letters of a technical nature signed by salesmen; they feel that they are being made the target of salesmanship and will prefer a firm which sends a technical report, signed by the responsible engineer, together with a separate tender, in which the sales force does its job of offering goods for sale and nothing more.

Provided each is willing to see the other's point of view, there is no reason why the engineer and his sales manager should not work in harmony. The engineer must not antagonize good customers by undue frankness, and the sales manager must respect the engineer's technical knowledge. In some offices, though, the custom is that when the illuminating engineer is not actually engaged on a scheme for a specific customer, he is given any clerical job which may need to be done, such as adding up salesmen's turnover figures and pricing invoices.

It should be obvious that this is the quickest way to kill the enthusiasm of a keen young man, and it is a little surprising that firms which would never consider wasting the time of, say, a transformer designer in this way, will, as a matter of course, expect their illuminating specialist to do office boys' work.

If the demand for lighting schemes falls permanently below what is necessary to keep the engineer fully occupied, one remedy is to share his services between two offices. Another method of organizing the preparation of schemes is to centralize it in one office; this has the advantage of keeping the technical control in the hands of the chief engineer, and ensuring that all the special experience in the firm is available at the same place, when an unusual problem arises. With such a central office, each individual engineer feels that he is one of a team, and that he is responsible to an engineer and not a salesman.

The drawback of this method of organization is that the cost of travelling to inspect sites of prospective installations is heavy, both in time and in money. Such visits are very necessary, as every illuminating engineer knows that a plan entitled, say, "Proposed extension to foundry, 1921," is no real guide to the present dimensions of the building.

It is to meet the difficulties outlined above that the lighting sales engineer was evolved. He is regarded as a salesman, charged with the responsibility of making his own contacts and also capable of designing his own schemes. He may be an engineer promoted to salesman, or a salesman promoted to engineer (depending on the firm). This arrangement can be very successful provided that certain conditions are satisfied. First, he must be as good an illuminating engineer as the man who concentrates on schemes without doing any selling. Secondly, he must have the temperament required for approaching new customers—not every engineer has this. Thirdly, his activities must not clash with those of the routine salesmen, otherwise there will be constant friction over credit for orders.

There is no one ideal way of fitting an illuminating engineer into an organization; the way in which he works must take into account a number of factors, including the personalities of those concerned. But illumination matters will never have the same prestige as generation and distribution until the fully trained illuminating engineer is acknowledged to be equal in status to any other qualified engineer. His necessarily close connection with a sales office militates against this in engineering circles, but it must be realized that all engineers live by somebody's sales and that illumination is not quite the simple rule-of-thumb matter it might at first seem.

It is essential for the well-being of the lighting equipment manufacturers that the illuminating engineer should receive his proper status, both within his firm, and within the profession of engineering.

* Principal, Technical College, Radcliffe, Lancs.

GAS PRODUCER POWER PLANT

IN the remote inland parts of Western Queensland water shortage precludes the operation of steam generation stations. These areas are consequently dependent on oil and gas engine plant, and electricity charges are comparatively high. Last year an installation employing coal-burning gas producers, believed to be the first of its kind in the country, was tested. Consumption per kWh generated averaged 1·8 lb of coal (£4 6s a ton) compared with 2 lb of charcoal (£10 a ton) and 0·8 lb of oil (£35 9s a ton). Taking a station with an annual output of two million kWh, such as that at Longreach where the initial plant has been installed, the fuel costs would be £6,900 (coal), £17,850 (charcoal) and £24,600 (oil).

Referring to this development, the State Electricity Commission says that coal-burning gas producers are now being installed at Dalby, Emerald, Blackall and Barcaldine, and further extension of their use is likely.

Royal Society of Arts Bi-Centenary

How the Society has Fostered Electrical Progress

By A. G. THOMSON

NEXT Monday a body which has been closely associated with the development of the electrical industry will celebrate the two-hundredth anniversary of its foundation. This is the Royal Society of Arts, whose aims are the advancement, development and application of every department of science in connection with arts, manufactures and commerce. In its early days it was the only society in Britain devoted to the furtherance of any of these activities; to-day it is the only society maintaining an interest in the whole of this wide field.

It was in 1753 that a Northampton drawing-master, William Shipley, published proposals for "raising by subscription a fund to be distributed in premiums for the promotion of improvement in the liberal arts and sciences, manufactures, etc." Failing to obtain support for his scheme locally, Shipley went to London, where he had introductions to a few men with similar ideas, among them being Viscount Folkestone and Lord Romney. These two were present with Shipley and eight others at a meeting on 22nd March, 1754, which resulted in the foundation of "The Society for the Encouragement of Arts, Manufactures and Commerce in Great Britain."

The method of "encouragement" proposed by Shipley was the offer and award of "premiums," which achieved remarkable and far-reaching results in the simpler economy of the eighteenth century. In the first hundred years of its existence the Society spent over £100,000 in promoting arts, manufactures and commerce by way of prizes and medals. The selection of suitable objects for the offers of premiums and the adjudging of the awards constituted almost the sole business at the Society's meetings for many years, and during the earlier part of the nineteenth century its annual prize-giving was one of the major events of the season.

Among the most memorable awards given by the Society was one in 1825 of a silver medal and thirty guineas to W. Sturgeon for an "improved electro-magnetic apparatus." It consisted of a horseshoe-shaped bar of soft iron coated with varnish, on which was wrapped a spiral coil of bare copper wire. The iron core could sustain about twenty times its own weight when magnetized. Sturgeon described this apparatus in a paper published in the *Transactions*, which proves him to have been undoubtedly the inventor of the electro-magnet.

In a paper delivered to the Society to commemorate the centenary of this award, Professor J. A. (later Sir Ambrose) Fleming pointed out that the electro-magnet in some form or another was the fundamental element in the dynamo, the electric motor, the transformer, nearly every telegraphic instrument, the telephone and the electric bell, and was the most effective means of exerting mechanical force at a distance, or activating and controlling mechanisms of any kind. "The unsolved problems of ferromagnetism are many and complex," added Professor Fleming, "and we cannot yet say that we understand even imperfectly the phenomena associated with Sturgeon's magnet."

In contributing to the discussion on this paper, Dr. J. F. Crowley made the point that before 1820 an association between magnetism and electricity had been suspected, though it had not to any extent been demonstrated, but during the years intervening between that date and Faraday's epoch-making discovery in 1831, that connection had been made definitely clear. Since that time the association between chemistry and electricity had also been demonstrated. The period was one of peculiar interest to the electrical engineer, because if electrical engineering could be traced to any clear origin, it would certainly be traced to the electro-magnet of Sturgeon and to Faraday's production of electricity by the movement of coils of wire in the neighbourhood of a magnet.

Another notable award was made in 1840 when Alfred Smee was presented with a gold medal for his galvanic battery. At that time there was still an urgent need for a convenient source of electrical energy, and Smee's cell represented a notable advance. It was fairly constant, moderately cheap, of high electromotive force, free from fumes, and could readily be put in and out of action without loss or waste. It was extensively used for many years and has been described as one of the most valuable gifts ever made to electrical science. A special feature was the use of platinum-coated silver instead of copper for the negative plate as a means of reducing the accumulation of hydrogen on its surface. This plate was supported in a light wooden frame between two zinc plates, which formed the positive element. The exciting fluid was dilute sulphuric acid.

A few years later the Society made an important contribution to progress in the field of telegraphy. Through one of its corresponding members, Dr. Montgomerie of Singapore, it was instrumental in introducing gutta-percha to Britain. At its meeting on 19th March, 1845, when the properties of gutta-percha were being demonstrated, Michael Faraday suggested to William Siemens that this material, being impervious to water, might be a useful insulator. It was by following up this information that the development of submarine electric cables was made possible.

Early Electric Lighting

The Society was prominently associated with the rapid developments which followed the discoveries of Swan and Edison. On 4th December, 1878, its building in John Adam Street, Adelphi, was lighted for the first time by dynamo-produced electricity. To illustrate a paper delivered by J. N. Schoolbred on that date, a Gramme dynamo in the library, driven by a Crossley gas engine, worked a Hallé lamp in the entrance hall and a Suisse lamp in the ante-room, while the lecture hall was lighted by a Siemens lamp supplied from a Siemens dynamo in the back yard driven by a Brotherhood steam engine.

Incandescent lamps made their first appearance in the building on 28th March, 1881, when Swan personally demonstrated his "glow-lamp" at a lecture by W. G. Adams. Two days later a lecture by Sir William Preece was lighted by arc lamps and incandescent lighting. The chairman of the meeting was Sir William Siemens and among those present were Varley, Swan and Crompton. At another lecture by Preedy in December of the same

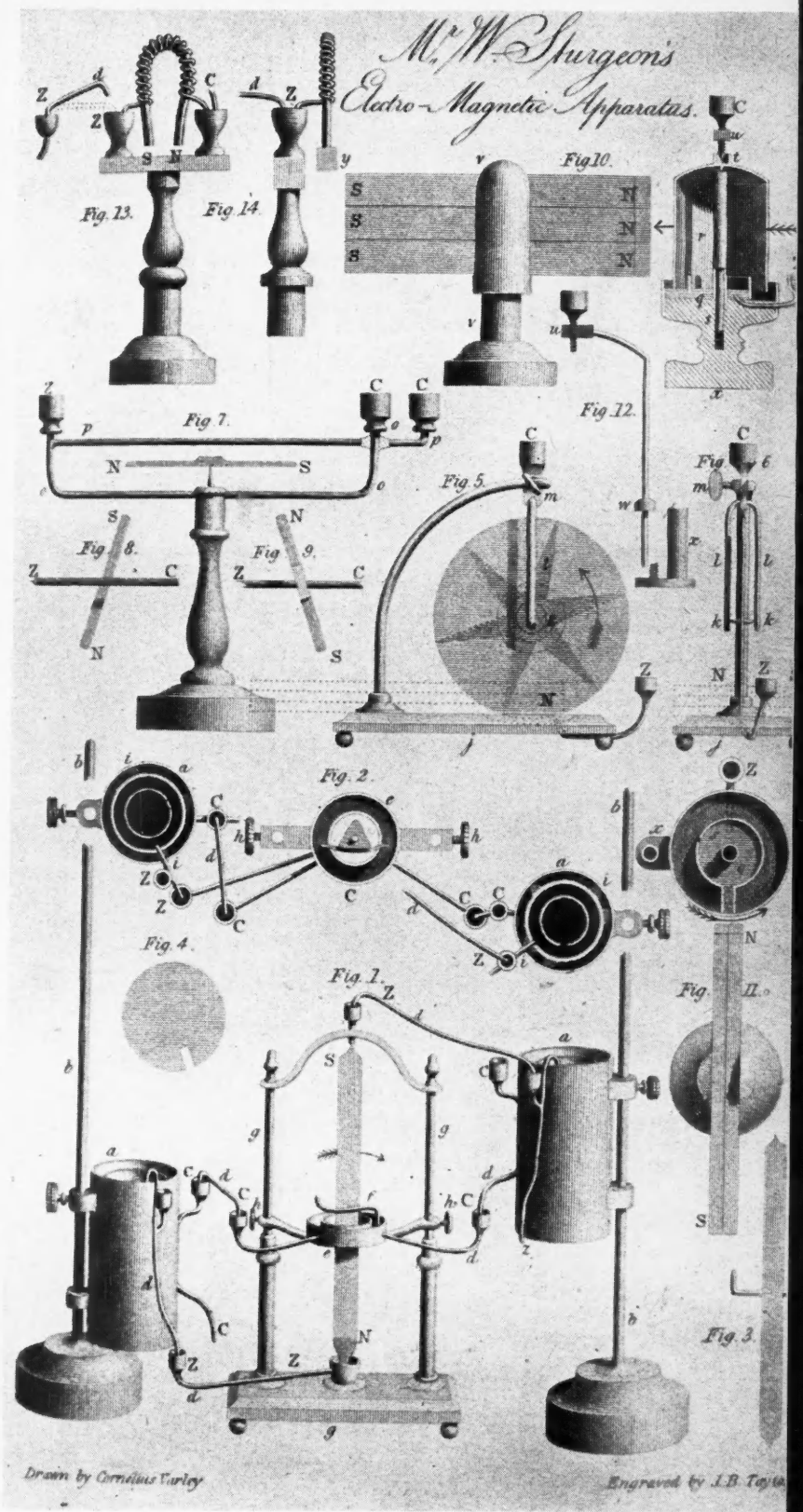
ear, the Society's room was lighted by Edison lamps energized by an Edison generator, this being the first time that the complete Edison system of lighting had been shown to an English audience.

By this time the heavy equipment required for such displays was in such frequent demand at meetings that some members of the Council decided to present the Society with a Crossley gas engine. Soon afterwards a Siemens generator was purchased and a general lighting system was permanently installed in time for the inaugural address by Sir William Siemens in November, 1882. This installation was one of the first in London. A storage battery was added in 1886 and the system remained in use until 1889, when it became possible for the building to be supplied from the mains.

The provision of mains electricity was considerably retarded by the first Electric Lighting Act (1882), so that many householders wishing to install electric lighting generated their own current. The Council therefore decided in 1886 to offer four gold and two silver medals for the best engines of any type which would drive a dynamo. Only four engines were entered, all of which received a gold medal after very extensive trials. They were an Atkinson, a Crossley and a Griffin gas engines and a Paxman steam engine.

The dissemination of knowledge is among the most important methods adopted by the Society to attain its objects. When it became clear that the offer of premiums was becoming a less effective form of "encouragement," it was decided that the Society could best serve inventors by giving them the opportunity for publicity. Hence the practice was instituted of holding meetings at which new scientific discoveries and their applications could be described and discussed.

There were few prominent technical and scientific discoveries during the nineteenth century whose introduction to public use was not assisted in this way by the Society of Arts. Among the more notable lectures were Graham Bell's description of the telephone in 1877 (the first public demonstration in London of this invention) and reports by Marconi of some of his inventions in 1901 and 1924. "It is easy to understand," said Marconi, in announcing to the Society his successful achievement of wireless telegraphy, "that if we have several receiving stations, each tuned to a different period of electrical vibration, and of which the corresponding inductance and capacity at any of the transmitting stations are known, it will not be difficult to transmit to every one of them, without danger of the message being picked up by the other stations for which it was not intended. But better than



Sturgeon's electro-magnetic apparatus

this, we can connect to the same vertical sending wire, through connections of different inductance, several differently tuned transmitters, and to the receiving vertical wire a number of corresponding receivers. Different messages can be sent by each transmitter connected to the same radiating wire simultaneously, and received equally simultaneously by the vertical wire connected to differently tuned receivers."

Transport is another field in which the Society has long taken an active and constructive interest. As early as 1857, W. Bridges Adam read a paper on " The Application of Rails for Horse Transport in the Streets of London," in which he advocated laying down tramlines. In 1872, shortly before his death, he urged the substitution of mechanical for equine motive power. The Society took up this suggestion enthusiastically, a prize of £25 being offered the following year for an engine using any type of motive power, suitable for being built into and driving a tramcar. This prize was awarded in 1875 for a steam engine designed by John Grantham. Before many years, however, Adam's aim had been fulfilled by the development of electric motors and the central production of electricity. This was clearly indicated in a report made in 1885 by Sir Douglas Galton, the chairman of the Council, on a competition held in connection with the international exhibition at Antwerp in 1885. Electric traction was discussed in several lectures to the Society during the next twenty years.

The Society was the originator of the first international exhibition, the Great Exhibition of 1851. The final organization of this Exhibition was taken over by a Royal Commission, but the Society continued to play an important part in connection with succeeding international exhibitions and also organized a number of small but interesting displays of its own. Reference should also be made to the very active encouragement which the Society has given to industrial design. It conducts an annual competition for the award of scholarships and travelling studentships to art students and young designers engaged in or intending to enter industry and recently some fifteen bursaries, of a value in most cases of £150 each, have been awarded annually. This competition has enjoyed the active support of manufacturers and official bodies. The Council awards the distinction of Royal Designer for Industry, which is the highest in the field of industrial art; it may at no time be held by more than forty designers and applications for its award are not entertained.

" I shall be obliged," wrote a correspondent whose letter was published in the Society's *Journal* of 30th October, 1857, " if any of your readers can inform me whether among the several plans and modifications suggested in the apparatus recently introduced in England and France for perfecting the electric light, any of them are likely to render it conveniently economic and permanent, so as to fit it for domestic and general use. This seems to be of immense importance in connection with the lighthouse system." There can be little doubt that the practical encouragement consistently given by the Royal Society of Arts has played an important part in accelerating the development of electricity in the manner desired.

Outdoor Generating Plant

FEW existing power stations in the United States are of the completely outdoor type, *Power* states, but 38 per cent of new plant capacity to be installed in 1953 to 1956 will be associated with outdoor or semi-outdoor boilers; only 21 per cent will have similar turbo-generator arrangements. Housing for certain plant items has been progressively reduced in recent years and this tendency, together with the growing use of inexpensive lightweight materials, e.g., corrugated asbestos, has lessened the incentive to adopt outdoor designs. Although lower capital costs have been consistently obtained by the elimination of masonry in varying degrees, these can be offset by delays in maintenance, heat losses and costs of weather protection in special cases. Power station operating staffs are said to prefer an outdoor construction because of the advantages of a cooler plant during many months. Temporary shelters are, however, required for construction and maintenance staffs.

One power company tabulates the capital savings for four plants, which average more than $4 per kW, compared with $3 to $7/kW as quoted by others. Another company compares savings for enclosures to suit minimum, mild-climate and cold-climate conditions. The additional heat loss from an outdoor boiler is calculated in a further case to be 0·75 per cent, which is equal to 94 per cent of the cost of a boiler enclosure. The saving is regarded as an inadequate inducement in view of emergency repairs which may be required in midwinter since, if unfavourable weather prolongs " outages " by 1⅓ days a year, the incremental cost of a building is more than met. The cost of prolonging maintenance time on a different system is given as from $1,000 to $3,000 a day. Experience with noise nuisance has varied. One suggestion is that buildings of indoor plants act as sound boxes to project the aggregate noise as a loud rumble, whereas noise from outdoor equipment attenuates rapidly without amplification. Acoustical barriers and orientation of plant to minimize reflection and beaming of sound are among the measures adopted in other instances.

World Power Conference

THE period to be occupied by the Brazilian Sectional Meeting of the World Power Conference and by the associated tour has been extended by two days, and is now 25th July to 10th August next. The technical sessions will be held from 25th to 31st July at the Hotel Quitandinha, Petropolis, and the tour will take place from 1st to 10th August.

An up-to-date list of the 42 United Kingdom and other British participants is now available. Those going to Brazil for the Conference include Lord Citrine, chairman, British Electricity Authority; Sir John Hacking, vice-chairman of the British National Committee, World Power Conference; Dame Caroline Haslett, director, Electrical Association for Women and a part-time member of the British Electricity Authority; and Mr. H. Nimmo, chairman, Southern Electricity Board.

It is announced that the Fifth World Power Conference will be held in Vienna during the summer of 1956. This will be the first plenary World Power Conference since the Conference in London in 1950.

After the forthcoming Conference in Brazil future Sectional Meetings are likely to take place in Canada in 1958 and Switzerland in 1960. A preliminary invitation has recently been received from the Australian National Committee, and it is possible that a Sectional Meeting may be held in Australia in 1961.

VIEWS on the NEWS

By REFLECTOR

BANKSIDE power station came in for some adverse criticism in the House of Commons last week. Sir Herbert Williams was the most pungent critic and as he was the director of the former Incorporated Association of Electric Power Companies his strictures were not prompted by any anti-electrical bias. Sulphur emission was the principal ground of Sir Herbert's complaint and he described it as a tragedy for St. Paul's Cathedral that oil instead of coal was the fuel employed at Bankside. It must also be a tragedy for the B.E.A. staff at Bankside Building just behind the station; the *Electrical Review* offices, too, are not far away. Sir Herbert also had something to say about Bankside's tall square chimney. This is certainly a too-prominent feature of the right bank of the Thames but it possesses slightly more architectural merit than the collection of short steel chimneys surmounting the earlier Bankside station which it is designed to supplant.

* * *

Dickens, who died 84 years ago, would still feel at home in the side streets of Holborn in the West Central district of London if he visited them by night. The Victorian atmosphere in which the neighbourhood is bathed owes its persistence mainly to the dismal gas lighting which still defies the march of progress. In the main thoroughfares of the borough, however, there has been a dramatic transformation through the introduction of abundant fluorescent lighting. Whether intentionally or not I cannot say, but an inspection arranged by the company responsible for the new illumination began with a brief tour of the gas-lighted side streets. Then when the coaches plunged into the new fluorescence it seemed to the visitors as though they had jumped a century, with exhilarating effect. It was a sudden revelation of the advance which street lighting has made in recent years.

* * *

My attention has been drawn to a beautiful example of modern craftsmanship in the shape of the new mace for the City of Singapore designed by Mr. C. d'O. Pilkington Jackson, the Scottish sculptor, and made by Hamilton & Inches, the Scottish goldsmiths. A photograph shows it to be a remarkable piece of work, intricate and symbolic of various aspects of Singapore life and tradition. But really it was a secondary consideration which prompted my informants to send the particulars. For the electrolytic bath in which the silver shaft of the mace was gold plated an inverted fluorescent lighting trough was used. In the few remaining silver craftsmen's workshops in Great Britain many of the tools and processes are improvised for the particular job in hand and in this case the trough just fitted the occasion.

* * *

Under the heading "The Power War is Due" the Glasgow *Daily Record and Mail* reports the dissatisfaction of some of the people in the South East Scotland electricity area at the progress of rural electrification. A representative of Hawick (Mr. J. Rutherford) told the Consultative Council that the amount of expenditure allocated to his subarea was totally inadequate. The report goes on to say:—

> "Unless the South East Scotland Board woke up it would find Border customers going over to the North of England Electricity Board. It had promised Mr. Rutherford that it could develop the rural area covered by his committee in 12 months."

Now this raises two questions. First, is the "North of England Electricity Board" (of which I have had no previous knowledge) permitted to poach on Scottish preserves in the way suggested? And does this herald a new separatist movement against the *apartheid* policy which the Scottish nationalists have successfully imposed?

* * *

A Wallasey housewife was recently commended for her ingenuity by the *Liverpool Daily Post* because she conceived the idea of using a hair dryer as a bedwarmer. The newspaper was later put right by a reader who pointed to the danger of overheating and fire likely to arise if the air circulation was restricted in this way. Newspapers should be careful not to give publicity to such abuses of electrical appliances for too many people are likely to indulge in them with unfortunate results.

Another bedtime story comes from the *Lowestoft Journal*. The writer says that an acquaintance of his decided to sleep with his electric blanket switched on. He was startled by periodical "clicks" and jumped out of bed and pulled out the plug before, as he thought, the blanket burst into flames. Next day he took it back to the shop from which he obtained it and was assured by the assistant that the clicks were merely from the operation of the thermostat. He was told "The time to start worrying is when you don't hear the clicks" and since then, the writer says, he has had sleepless nights listening to make sure the blanket is still "clicking."

* * *

Alison Settle, reporting on the Ideal Home Exhibition in the *Observer*, says:—

> "Hoping to replace that faithful friend, my bedroom fire with gas-ring incorporated, I discovered that such rings have now been eliminated—the gas industry expects us to use an electric kettle."

If true, this is an unexpected gesture from the gas people for which the electrical industry should be duly grateful.

* * *

The formation of one of the earliest electricity producing concerns was recorded in the *Electrical Review* of eighty years ago (15th March, 1874). It was the Electrical Power Co., the purpose of which was said to be the

> "taking over of Gramme's Magneto-Electric Machine. The immediate objects of the Company are the economical development of electric power, more especially in its application to telegraphy, electro-plating, electric chucks, electric light, railways and the production of chemically pure copper, aluminium, caustic soda, etc."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

THE Illuminating Engineering Society has conferred honorary membership upon **Sir John Herbert Parsons,** C.B.E., the famous ophthalmologist. Sir John, who is eighty-five, is a past-president of the Society and was the first chairman of its Council. He is the oldest living founder-member and was present at the informal dinner in February, 1909, when it was decided to form the Society. He was actually invited to become its first president but declined because he felt that, during its inaugural year, it would be more fitting if an engineer rather than an ophthalmologist held office. He was elected president in 1921, and in the same year became a Fellow of the Royal Society. He was knighted in the following year. For many years Sir John was surgeon and, later, consulting surgeon at the Royal London Ophthalmic Hospital (Moorfields), as well as ophthalmic surgeon and, subsequently, consultant at University College Hospital, London. The certificate recording the award was presented to him by the president of the Society, Mr. W. R. Stevens, at a meeting of the Council held on 9th March.

Mr. E. H. Nichols has been appointed manager of the Norwich branch of W. T. Henley's Telegraph Works Co., Ltd., in succession to **Mr. J. Newton,** who has retired after forty-five years' service with the company. Mr. Nichols joined Henley's head office in 1923 and for over twenty-one years has been a representative at the Norwich branch.

Mr. E. H. Nichols

Mr. P. H. Scrine

Mr. P. H. Scrine, who was personal assistant to the manager for India and Pakistan of W. T. Henley's Telegraph Works Co., Ltd., has been appointed assistant manager for India.

Mr. R. M. Ll. Evans, B.A.(Cantab), M.I.E.E., has been appointed a director of the Watford Electric & Manufacturing Co., Ltd., in addition to his executive position as chief electrical engineer. Before joining the company in 1951, Mr. Evans was on the staff of the Director of Electrical Engineering, Admiralty, and was formerly with the Metropolitan-Vickers Electrical Co., Ltd.

Mr. Edward Binns, M.I.Mech.E., A.M.I.E.E., who recently retired from the post of manager of No. 3 (Oldham) Sub-Area of the North Western Electricity Board, has joined Mr. Ralph B. Giles, consulting engineer, who was formerly electrical consultant to the Ministry of Aircraft Production. Mr. Binns was previously chief engineer and manager of the Oldham Corporation electricity undertaking, which included the two power stations at Chadderton and Greenhill. He was a member of the team representing the electricity supply industry which visited the United States in 1949 under the auspices of the Anglo-American Council of Productivity.

Mr. F. A. Croft has been appointed manager of the electrical installation contracts department of Walker Bros. (Electrical Engineers), Ltd., Birmingham, in succession to the late Mr. F. Penson.

Mr. W. Kearsley, F.I.M.T.A., principal assistant in the accountancy section of the North Western Electricity Board's No. 5 Sub-Area (Blackburn) has been appointed accountant of No. 2 Sub-Area (Bolton). He will succeed **Mr. V. T. T. Atkinson,** A.I.A.C., who retires at the beginning of May. Mr. Atkinson became No. 2 Sub-Area accountant on nationalization in 1948, after over forty years with the Lancashire Electric Power Co. by whom he was appointed chief accountant in 1945 and given the additional responsibility of assistant secretary in 1947.

Nearly 400 apprentices and guests attended the annual dinner of the G.E.C. **Witton Apprentices' Association** at the Magnet Club, Witton, on 6th March. Among the guests were Mr. R. C. Giggins, a director of the G.E.C., and Mr. J. Wilson, principal of the College of Technology, Birmingham. The toast of the association was proposed by Mr. Giggins, who presented a complete set of the "War Memoirs" of Sir Winston Churchill to the apprentices' library at Castle Bromwich Hall. The chairman of the association, Mr. R. C. Beard, a graduate apprentice from Australia, responded. Mr. D. L. Davies, vice-chairman of the association, proposed the toast of the guests to which Mr. J. Wilson replied.

Mr. R. C. Giggins, a director of the G.E.C., presenting the apprentices' cup to Mr. D. Ainsworth at the annual dinner of the Witton Apprentices' Association

During the evening Mr. Giggins presented various awards to apprentices, and the function was brought to a close with a revue "Alice in Blunderland," written by the apprentices themselves.

Mr. R. C. Hodson, Associate I.E.E., M.Inst.F., has been appointed power station superintendent at Skelton Grange power station, Leeds, Yorkshire Division, B.E.A., and will be taking up his duties on 1st April. He is at present superintendent of the Kirkstall power station. Mr. Hodson started his career with the Leeds Corporation electricity undertaking and held various posts at Whitehall Road and Kirkstall power stations.

Mr. A. W. Montgomery, joint general manager of Standard Telephones & Cables, Ltd., has been elected a Fellow of the American Institute of Radio Engineers for his leadership in radio and telecommunication research in England, and his services in the international liaison in these fields.

Alderman John Morris, who has been nominated as the next Mayor of Crosby, is a member of the commercial staff of the Merseyside and North Wales Electricity Board.

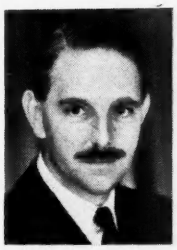
The Metropolitan-Vickers Electrical Co., Ltd., has announced that, consequent upon the transfer of **Mr. C. P. Storr** to the Dominions Division of the Metropolitan-Vickers Electrical Export Co., Ltd., **Mr. J. G. Miles,** B.Sc.(Eng.), has been appointed the company's power systems engineer as from 1st January. Mr. Miles was educated at Judd School, Tonbridge, and at Brighton Technical College,

from which he obtained his degree at London University. He joined the Metropolitan-Vickers Electrical Co. as a college apprentice in 1948, afterwards joining the Instrument and Meter Engineering Department. In 1951 he was awarded an A.E.I. Fellowship to the General Electric Co., Schenectady. Following short periods spent successively in the switchgear, plant and transformer engineering departments, he joined Mr. Storr on the latter's appointment as power systems engineer early in 1953.

Mr. R. F. Gyngell, secretary of W. T. Henley's Telegraph Works Co., Ltd., will retire on 31st March after forty-two years' service, and **Mr. S. J. Beaney,** the present assistant secretary, has been appointed secretary as from 1st April.

Mr. R. A. West, B.Sc., A.M.I.E.E., has relinquished his duties at Bedford to take up a position with Contactor Switchgear, Ltd., Wolverhampton.

Mr. P. M. Hollingsworth, M.Eng., M.I.E.E., M.Amer.I.E.E., has recently been appointed chief engineer of the power cables division of British Insulated Callender's Cables, Ltd., to succeed **Mr. W. P. Fuller** on his eventual retirement. Mr. Hollingsworth received his education at Stonyhurst College and at Liverpool University, and entered the cable industry in 1928 when he joined the outside engineering staff of the British Insulated Cables, Ltd. Two years later he was transferred to the Research Department at Prescot where he was engaged in the testing and development of high voltage cables.



Mr. P. M. Hollingsworth

In 1938 Mr. Hollingsworth joined Johnson & Phillips, Ltd., as head of the Paper Cable Test and Research Department, and during the war took charge also of technical work on thermoplastic cables supplied to the Services. Immediately after the war he was appointed cable test and research manager of the company with control of engineering and development for all types of cables, and in this capacity played a leading part in the introduction of aluminium-sheathed cables in 1948. Mr. Hollingsworth's new appointment with B.I.C.C. involves responsibility for the design and quality of power cables of all types and for applied research in cables and materials. He will be stationed at 21, Bloomsbury Street, London.

Mr. A. G. Norman, managing director of Thomas De La Rue & Co., Ltd., arrived in the United States on 13th March to begin a 25,000 mile business trip and survey of his company's overseas sales organization. From America he will fly to Sydney, Australia, for discussions with the company's agents. He will spend two weeks in Australia, and on his way home will visit Karachi.

A bureau bookcase and a grandfather clock have been presented to **Mr. R. Hodgson** to mark his retirement from the post of district engineer with the North Eastern Electricity Board, Middlesbrough.

Mr. G. Pool, senior superintendent of erections for C. A. Parsons & Co., Ltd., is to be manager of the company's factory now being built at Whyalla, South Australia.

Mr. E. Y. Caswell has relinquished his duties as manager of the Bristol district of the Skefko Ball Bearing Co., Ltd., to join the executive staff at the company's head office as sales manager.

Mr. R. G. Sutton has been appointed secretary to Simms Motor Units, Ltd., in addition to his present position of chief accountant.

Miss Janet Evans and **Miss Doreen Lakin** have been appointed demonstrators with the Revo Electric Co., Ltd. Miss Evans who, before nationalization of the electricity supply industry, was with the Northmet Power Co. and the County of London Electric Supply Co. has recently returned from five years' service with the East African Power & Light Co. She will be based at the London office, and will be responsible for demonstrations in London and the South.

Miss Lakin, who will operate from the head office, will be responsible for the Midlands and East Midlands territories. She previously served with the Midlands Electricity Board at Walsall.

Mr. A. G. Peacock, B.Sc., A.R.I.C., A.Inst.P., has resigned his position as secretary of the Scientific Instrument Manufacturers' Association and has joined the board of Mervyn Instruments, Woking.

Towards the end of last year a small band of lighting engineers decided to form an association for the promotion of goodwill and fellowship among those engaged in the lighting industry, and benevolence. As sellers of light it was decided to call the new body the "**Lightmongers.**" There were 15 founder members; the present membership is 35, and a number of applications are under consideration.

The first social evening was held at the La Coquille Restaurant, St. Martin's Lane, London, last week, when a small gathering sat down to dinner under the genial presidency of Mr. Max Miller (the Benjamin Electric, Ltd.). In replying to the toast of the Lightmongers, proposed by Mr. T. Jones (Crompton Parkinson, Ltd.), Mr. Miller briefly explained the reasons for the formation of the association and said that it was their intention to meet three or four times a year. It was hoped to make donations from time to time to the E.I.B.A. or other benevolent funds within the industry.

Mr. W. Vaness (Metropolitan-Vickers), the vice-president, in proposing the toast of the guests, said that while they would welcome new members, only those engaged in the lighting industry would be eligible. Mr. J. Woods responded for the guests. The hon. secretary of the Lightmongers is Mr. V. Gardner (Benjamin Electric, Ltd.) and the hon. treasurer is Mr. R. Stevens (Cryselco, Ltd.).

At the annual dinner and dance of the **Norfolk Electrical Development Circle** at Norwich on 10th March, there were over 300 members and their ladies present.

The Deputy Lord Mayor of Norwich (Mr. C. H. Sutton) urged the Circle to try and bring about three things, a reduction in the price of electricity, the education of consumers to observe more effective safety measures, and the issue of tariff lists that users could understand. After 17 years it had been found cheaper to heat Norwich City Hall by oil instead of electricity. Too many consumers were trying to do electrical work themselves instead of calling in trained electricians and that led to accidents.

Mr. W. Sleap, chairman of the Norwich Branch of the Electrical Contractors' Association, said that the Deputy Lord Mayor's suggestions were a matter for the Electricity Authority rather than his Association. Mr. J. A. Sumner, manager of the Norfolk Sub-Area, Eastern Electricity Board, proposed the toast of the ladies, and Mrs. H. Lyon replied. Mr. H. Lyon, chairman of the Development Circle, presided.

The annual Apprentices' Night of **Johnson & Phillips, Ltd.,** was held recently when Mr. G. Leslie Wates, chairman of the company, presented the awards. Mr. W. Glass, joint managing director, described some of

Mr. G. Leslie Wates, J.P., chairman of J. & P., presenting a silver medal to Mr. D. J. Maynard

the highlights which he and his colleagues had encountered during their recent visit to Russia.

The successful apprentices included Mr. D. T. Perkins (bronze medal), Messrs. D. J. Maynard and F. R. Craddock (silver medals) and Mr. D. M. Martin (gilt silver medal). Among those who attended the presentation were Dr. E. S. Gyngell, principal, Dartford Technical College, and Dr. J. S. Tait, principal, Woolwich Polytechnic.

The Minister of Fuel and Power has made a number of appointments and re-appointments to the London Electricity Consultative Council. The chairman is **Mr. I. J. Hayward,** J.P., LL.D., the deputy chairman, **Mr. W. Howes,** M.I.Mech.E., M.I.E.E., and the members include **Councillor G. H. R. Martin,** A.M.I.E.E., **Mr. T. B. Penruddocke,** chief electrical engineer, Associated Portland Cement Manufacturers, and **Mr. A. E. Westlake,** A.M.I.Mech.E., Associate I.E.E., M.Inst.F.

The annual dinner of the Essex Electricity Supply Sports and Social Club of the **Eastern Electricity Board,** South West Essex District, was held at the White Hart Hotel, Romford, on 5th March, when about 130 members, friends and a number of representatives of manufacturing concerns attended. The chairman was Mr. R. A. Archer, district commercial engineer, Romford, who was accompanied by Mrs. Archer. The toast of the Club was proposed by Mr. R. H. M. Barkham, manager, Essex Sub-Area, and Mr. R. W. J. Benyon, district manager and president of the Club, responded. The toast to the ladies and guests was given by Mr. A. Kidd and responses were made by Mr. W. E. Wardrop, commercial officer, Essex Sub-Area, and Mr. J. E. Kinnersley, of the London Electricity Board.

The next production of the **Portland Players** (the Dramatic Section of the B.E.A. Sports and Social Club) will be Emlyn Williams' "Night Must Fall" at the Duchy Theatre, London, S.E., on 1st April. Tickets are obtainable from the secretary, Miss R. Futcher, The Library, B.E.A., Great Portland Street, London, W.1.

The Dramatic and Operatic Section of the Social and Athletic Club of **W. T. Glover & Co., Ltd.,** presented "Murder Out of Tune," by Falkland L. Cary, from 10th to 13th March.

Over 250 employees and their wives and friends attended a social evening and carnival dance held in London last Friday by **William Steward & Co., Ltd.,** to celebrate their twenty-first anniversary. Mr. W. E. Steward, managing director, who founded the company in 1933, was presented with a television set from all the employees.

OBITUARY

Mr. William Hector Moore, late contract manager of Pirelli-General Cable Works, Ltd., died at his home at Chandler's Ford, Hampshire, on 13th February at the age of seventy-five. After periods of service with other cable manufacturers he joined Pirelli-General in 1921 as a contract engineer and held successive appointments as contract supervisor and contract manager, retaining the latter position until his retirement in April, 1952.

Dr. F. C. Chalkin.—Among the victims of the airliner disaster at Singapore last week-end was Dr. Francis Cecil Chalkin, Professor of Physics at Canterbury University College, New Zealand, since 1947. From 1923 to 1927 he was Researcher, Wheatstone Laboratory, London University. He was an authority on X-rays and their use in atomic research.

WILLS

Mr. A. Aspinall, A.M.I.E.E., formerly borough electrical engineer at Brighouse, who died on 13th December last, left £3,833 gross (£3,779 net).

Mr. E. F. Behenna, district commercial engineer, Sevenoaks and Horley, South Eastern Electricity Board, who died on 23rd October last, left £6,450 gross (£6,228 net).

Mr. S. Kupfer, founder of W. and E. Kupfer, Ltd., who died on 26th August last, left £49,717 gross (£49,171 net).

Mr. L. L. Worthington, secretary of the B.T.H. (Rugby) Long Service Association, and secretary for the Rugby district of the Electrical Industries Benevolent Association, who died on 1st September, left £3,032 gross (£2,959 net).

ELECTRICIANS' STRIKES END

JUST after we went to press last week a statement announcing the settlement of the dispute in the electrical contracting industry was made by the National Federated Electrical Association.

This mentioned the unwillingness since 31st August last of the Electrical Trades Union to refer its wages claim to arbitration and the decision of the Minister of Labour to take no action on the N.F.E.A. reference to arbitration made on 6th January. The statement continued:—

> "The N.F.E.A. has continued to review the situation in the light of all relevant factors including the cost of living upon which basis the E.T.U. submitted its claim for a wages increase. Immediately following the issue on Friday, 26th February, 1954, of the Report of the Court of Inquiry in respect of the dispute in the engineering industry, the N.F.E.A. has given close and continuous examination to its contents. Whilst it is clear that its conclusions and recommendations are confined to the engineering industry, the N.F.E.A. recognizes their relevance to other industries.
>
> "In the light of this report, the N.F.E.A. is prepared to recommend to its members that an increase in wages of 2d per hour be granted to journeymen electricians (with proportionate increases to adult mates and apprentices) to operate on and from Monday, 15th March, 1954. This offer is subject to an undertaking by the E.T.U. to arrange a full resumption of work at the earliest possible moment.
>
> "Thereafter, the N.F.E.A. agrees to a meeting of the National Joint Industrial Council being held on Friday next, 12th March, 1954, in accordance with its constitution, to enable the E.T.U. to pursue their wages claim."

The offer made by the Association was accepted by the Union and on Thursday last week there was a general return to work of the men who had been on strike, numbering about 2,500 at the time of the settlement. A total of about 45,000 employees will receive the increase, adding approximately £15,000 to the weekly wages bill.

With the additional 2d an hour the new hourly rates for journeymen electricians are as follows: Grade "A" Area, 4s 2d; Mersey District, 3s 10d; Grade "B" Area, 3s 9d. For adult mates the figures are:—Bristol, 3s 1¾d; London, 3s 5¾d; Mersey District, 3s 0¾d; all other areas of England, Wales and Northern Ireland, 3s 0d. There are proportionate increases for apprentices and male labour under 21.

Mr. L. C. Penwill said at a Press conference on 10th March that both the Association and the Union maintained full freedom of action at the meeting of the N.J.I.C.

At the meeting of the N.J.I.C. on Friday last the Union put in a claim for a further increase, stated to be 2d an hour for London members and 1½d for others. The N.F.E.A. side agreed to consider the matter and give their reply on Monday last. At the resumed meeting, however, the employers said that they had not had long enough to discuss the demand. According to the Labour Reporter of *The Times* the Union leaders are understood to have refused to consider a further postponement and to have moved that the claim had been established in principle. All the Union's representatives voted for this motion but the employers are understood to have abstained.

Agreement has also been reached between the Electrical Contractors' Association of Scotland and the E.T.U. Electricians in the contracting industry will receive 2d an hour increase, raising the standard rate to 3s 9d. A similar increase for armature winders brings their rate to 3s 10d. Apprentices will receive proportionate increases.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

N.F.E.A.—A.S.E.E. Agreement

I HAVE been asked to write to you about the editorial that appeared in the issue of your journal dated 5th March, under the heading "Supervisors' Salaries."

In the report regarding the termination of the N.F.E.A.-A.S.E.E. agreement which you published in your issue dated 26th February, it was made clear that the A.S.E.E. Council had expressed its willingness to meet the N.F.E.A.'s stipulation as to the elimination from the agreement of supervising electrical engineers in order to be able to proceed with discussions relating to the staff foremen grades.

It was therefore with some surprise that the appropriate committee of the A.S.E.E. noted the total omission from your editorial of reference to the effect of the termination of the agreement upon the staff foremen in the contracting industry, especially as the committee is quite sure that the number of N.F.E.A. firms concerned with this grade of personnel appreciably exceeds the figure of 3 per cent which you quoted.

I am asked to inquire whether responsible employers in the electrical contracting industry consider the present position a satisfactory state of affairs.

New Barnet, Herts. E. A. BROMFIELD,
General Secretary,
Association of Supervising Electrical Engineers.

Electromagnetic Theory

I HAVE carefully studied the paper presented to the Institution of Electrical Engineers on 11th February by Mr. P. Hammond.

I must profoundly disagree that magnetic poles should be a starting point for magnetic and consequent electromagnetic theory. Unlike electric charges, magnetic poles as centres of radiating fields do not exist in nature and hence it is unethical to emphasize what may have been a convenience in the past as a pivot of truth when teaching students the fundamental principles of our science. It is extremely difficult to eradicate erroneous views picked up by students, especially when they are acquired with some apparent authority.

I am aware that many interesting elementary experiments with magnets must be taken away from students, since they depend on the supposition of magnetic poles. Likewise the puzzle of self-demagnetization must go. I do not think there is any difficulty in arriving at the requisite field equations without the idea of magnetic poles. The instance of the displacement current is entirely different. There are no means of ascertaining or verifying in nature such a current, and the equations need such a supposition for completeness, as Maxwell found out.

Having got our B and our D, the subsequent treatment by Mr. Hammond is masterly, but applicable, I think, only to advanced students of electrical engineering or physics. L. E. C. HUGHES, Ph.D., A.M.I.E.E.

*London, N.W.*8.

Study of American Industry

IF any of your readers had the opportunity of visiting America for four or five weeks in the autumn and were unrestricted, what programme would they follow in order to learn the maximum possible about developments in the electrical industry in the U.S.A.?

South Croydon, Surrey. J. JAMES.

SNOWY MOUNTAINS PROJECT

From Our Sydney Correspondent

THE Australian Minister for National Development announced recently that the Snowy Mountains Authority now estimated the cost of the Snowy hydro-electric scheme at £422 million, based on firm tender prices for the major works under the scheme. He said the Authority had received tenders from large contracting organizations in Australia, North America and Europe for constructional work on the Upper Tumut. Together with the Adaminaby dam, which was being built for the Authority by the N.S.W. Public Works Department, this would provide New South Wales with additional generating capacity of 80 MW by 1958 and of 320 MW by the end of 1959.

In 1948 the Commonwealth States Joint Technical Committee estimated the cost of the Snowy scheme, including transmission to Sydney and Melbourne, at £225 million, this figure being based on the costs of labour and materials current at that time. A second estimate, prepared in 1952 by the Snowy Mountains Authority, put the total cost, including transmission, at £442·5 million. This difference was accounted for by higher prices and by a substantial increase in the "firm," or guaranteed, capacity of the scheme. From time to time critics of the Snowy scheme have mentioned £600–£700 million and more as its probable cost.

Senator Spooner said that while the general opinion of electrical experts in all centres of Australia was that costs would not skyrocket up to the £600 or £700 million mark, the estimate was not a sufficiently firm basis to rely upon £422 million being anywhere near the peak cost when the scheme reached finality. In the early days of the scheme there were complaints from the States that they would have to duplicate some of the Snowy generating capacity in order to be sure of meeting power demands at all hours of the day. The Authority can now guarantee under all conditions 50 per cent more power than it could under the earlier plan and the scheme is capable of being adapted in almost any way the States desire. It is for the States to nominate their requirements, as it is now in their interests to further the scheme.

Besides keeping down the cost of electricity, the Snowy development will provide a great reserve of power for an emergency such as a war or a coal strike. It will make available a large quantity of water for irrigation in inland areas and will also help to mitigate the floods which cause widespread damage along the Murrumbidgee from time to time. These benefits, in the long run, will probably prove as significant as the power supply side of the scheme.

PARLIAMENTARY REPORT

WHEN the money resolution on the Atomic Energy Bill was considered in the House of Commons last week, Viscount Hinchingbrooke said there was no objection to the expenditure of huge sums by the proposed Corporation, but they should not be borne on the estimates. The Corporation might be allowed to borrow in the same way as the New Towns Corporations borrowed money.

Sir David Eccles, Minister of Works, pointed out that the resolution provided specifically that the money should be voted by Parliament in the annual estimate. The £50 million which he had mentioned on the second reading debate related only to the civilian side of atomic energy. This was a large sum but the prize was enormous. If the authority succeeded in developing power reactors it would lead to the generation of electricity with a new type of fuel. Then this great sum would seem small compared with the benefits which might accrue.

He added that they were still in the stage of development work, which did not lend itself to financing out of loans. At Dounreay they would be more concerned with getting information about the design and behaviour of reactors than electricity. They hoped that they were going to get a reasonable supply of electricity, but the primary object of the plant was to discover how to design such power stations in order that, with such modifications as might seem to be advisable, other people could afterwards put them up at an economic cost. They did not suppose for a moment that the electricity they got from Dounreay would be a paying proposition, because of the experimental work which would be carried on.

Mr. Woodburn asked whether, if the experiments were successful and the work of producing electricity was handed over to the North of Scotland Hydro-Electric Board and the B.E.A., those bodies would raise the money for future electricity stations.

Sir David Eccles said that was so. Presumably there would be some financial arrangement between the electricity authorities and the Corporation. The latter would sell the material and, no doubt, would get some royalties.

The resolution was agreed to.

Smokeless Zone in the City

After the City of London (Various Powers) Bill had been read a second time Sir Herbert Williams moved that it be an instruction to the Committee which is to consider the Bill to leave out Clause 4, which empowers the City Corporation to prohibit the emission of smoke in the City. He spoke of the deaths from the fogs of 15 months ago, and said that investigation and research were needed to find out where the danger lay. The major trouble was sulphur dioxide. Combined with moisture it produced sulphurous acid and if it could take a bit more oxygen from the air it became sulphuric acid. That was the main cause of the attack on our buildings and metalwork. If we could reduce the sulphur dioxide we could protect our public buildings, our health, and everything else.

Considerable efforts had been made to eliminate sulphur dioxide from power stations. Only three power stations in the world had had plant designed for the purpose. One was Fulham power station which had a sulphur dioxide washing plant, but this was out of action. The second was Battersea, which used coal, and the other was Bankside, which used oil. These devices were not only failures; in his judgment they were worse, for they were aggravating the problem. The great tragedy was Bankside. To-day St. Paul's Cathedral was in greater peril of destruction through sulphuric acid because there had been insistence on the Bankside station using oil fuel instead of coal, with a 4 per cent sulphur content instead of the 1½ per cent in coal. Bankside also had washing plant.

Sir Alfred Bossom, seconding, said that many members of the House would remember how parts of the stone pinnacles and pieces of stone used to fall off the river façade of the House on to the terrace. Stones of the wall had to be dug out and replaced by new ones, and he understood the cost of that was double the cost of the original erection over the whole façade. That sort of thing was going on all over London, and it was undoubtedly due to sulphuric acid penetrating and disintegrating the stones. There was no mention in the Bill of any attempt to prevent that. As the years went by he believed they would see the same damage to St. Paul's unless some action was taken. He referred to the example of Pittsburgh, which was at one time the dirtiest city in America. Four years ago local ordinances were passed that no smoke was to be allowed to come out of any chimneys except those of hospitals. To-day Pittsburgh was one of the cleanest cities in the world.

Sir Harold Webbe said it would seem that we were suffering from three troubles — sulphur dioxide, carbon monoxide and soot. The City of London was seeking the powers contained in the Bill because it was embarking on the colossal business of rebuilding large areas, and it was the most appropriate time to establish a smokeless zone so that new buildings could be designed to prevent the emission of smoke.

Mr. Marples said that the Government was determined to conquer the evil of air pollution generally. It would welcome carefully planned expansion of the smokeless zones. The Ministry of Fuel and Power had larger quantities of smokeless fuel than for a long time, as larger quantities of oil from the new refineries were being used by industry. It was estimated that there were 12 million houses with open fires.

The motion was, by leave, withdrawn.

Television Questions

Mr. Ernest Davies asked the Assistant Postmaster General whether, in view of the increase of the television licence fee to £3, he would arrange for payment to be made half-yearly.

Mr. Gammans said he would not; the cost would be too great. The possibility of introducing a special savings stamp card was being examined.

Mr. Driberg asked the Assistant Postmaster General why it was assumed that the television licence revenue must cover Post Office costs for dealing with interference; and if he would examine the possibility of recovering some part of these costs from undertakings causing the interference.

Mr. Gammans said that the costs in question were the costs of tracing the causes of interference—not the costs of effecting cures. This was part of the process of ensuring good reception of the television service and in the Government's view was properly to be borne by television viewers in general.

National Insurance Stamps

On Monday Mr. George Thomas asked the Minister of Works whether he was aware that electrical contractors added to all their bills 120 per cent of the cost of national insurance stamps for their workers; and what action he proposed to take to stop these employers profiteering through serving his department.

Mr. J. R. Bevins said he was aware that a form of contract for carrying out electrical installation work on a cost plus percentage basis had been drawn up by the trade association concerned and that, as was usual in this type of contract, the basis of payment was the reimbursement of the cost of labour, materials and other outgoings, plus varying percentages on these items to cover overheads and profit. Provision was made for an addition of 20 per cent to the cost of expenses associated with labour, including the contractor's contribution to national insurance. He had no responsibility for this document and this form of contract was not used by his department.

Electrical Engineers' Exhibition

SPEECHES AT OPENING CEREMONY

THANKS to the timely return to work of the electricians who had been on strike, the third Electrical Engineers' Exhibition organized by the Electrical Engineers (A.S.E.E.) Exhibition, Ltd., opened on Tuesday at Earls Court complete with full electrical installations. Occupying double the floor area and with more than one and a half times the number of exhibitors, this year's display is proving even more of an attraction than 1953's successful effort.

At the opening ceremony on Tuesday Mr. J. Flood, chairman of the Association of Supervising Electrical Engineers, welcomed visitors to the exhibition. In performing the official opening, Sir Henry Self, deputy chairman (administration), British Electricity Authority, said that the exhibition gave manufacturers the opportunity to make contact with users and enabled the general public to appreciate the progress that had been achieved. Referring to the exhibition's origin and development, Sir Henry said that there were 178 stands this year and other organizations which had participated in addition to the A.S.E.E. were the British Electrical and Allied Manufacturers' Association, the British Electricity Authority, the Cable Makers' Association, the Electrical Research Association, the Electrical Development Association, the Association of Electrical Machinery Trades, the Electrical Association for Women and the Electrical Industries' Benevolent Association. He drew attention to special features of the exhibition: a display of switchgear by twenty-two manufacturers, a stand dealing with atomic energy, and the competition for awards for the most outstanding new industrial and domestic labour-saving devices. He forecast a great success for the exhibition in this and future years.

After thanking Sir Henry, Mr. C. T. Melling, president of the A.S.E.E., announced the winners of the competition referred to. The English Electric Co., Ltd., received a plaque for the industrial exhibits for its "Superform" switchgear, Ferranti, Ltd., being runner-up for its high-speed electronic set for testing meters. Aidas Electric, Ltd., won the domestic labour-saving award for its "Sadia Select" 3 gal water heater, Tricity Cookers, Ltd., being second with its "Queen" cooker.

At an informal luncheon which followed the opening, Col. B. H. Leeson, director of the B.E.A.M.A., proposed the toast of the exhibition the organization of which, he said, called for great skill, initiative and hard work. The exhibition reflected the purpose of the A.S.E.E., which was mainly educational and had as its object the advancement of the cause of electrical science in engineering. In reply the chairman thanked the B.E.A.M.A. and all other organizations which had made the exhibition so representative.

Mr. E. J. Sutton, chairman of the Exhibition Organizing Committee, proposed the toast of the exhibitors and asked for constructive criticisms from present and potential exhibitors. Responding, Mr. H. W. Bosworth, chairman of Lancashire Dynamo Holdings, Ltd., expressed thanks to Lord Citrine and Sir Henry Self for attending and said that their presence tended to make them feel that the green light had been given for the development of electricity. He congratulated the organizers on their enterprise in holding the exhibition and hoped that it would become an annual event of ever-increasing range and importance.

Mr. P. A. Thorogood, general manager of the exhibition, spoke of the great support given by B.E.A.M.A. He said that next year the British electric motor would probably be the special feature, while in 1956 he thought they might tend towards the domestic aspect, with perhaps two or three days open to the public. A "Festival of Electricity" was suggested for the following year.

The "Electrical Review" stand at the Electrical Engineers' Exhibition at Earls Court

In our description of the display of Ekco-Ensign Electric, Ltd., on page 454 of our last week's issue the company's old address was given. Its present address is Preston House, 45, Essex Street, Strand, London, W.C.2.

Smoke Reduction Conference

Following representations made by a number of owners and occupiers of property in the City of London the Coal Utilization Council and the Combustion Engineering Association have decided jointly to hold a conference entitled "Smoke Reduction in the City of London (Solid and Liquid Fuels)" on Friday next at the Mansion House, London, commencing at 10 a.m. and closing at 4 p.m. The following addresses will be included in the morning and afternoon sessions: "The Available Fuel," by Sir John Charrington; "Smoke Reduction in Small and Domestic Appliances," by Mr. W. C. Moss, B.Sc. (Coal Utilization Council); "Sectional Boilers," by Mr. W. H. Gamble, B.Sc. (Eng.), F.Inst.F., and "Shell and Water Tube Boilers," by Mr. J. R. Kell, M.Inst.F.

INDUSTRIAL NEWS

Trade Talks with China

Crompton Parkinson, Ltd., is sending a representative, Mr. G. J. Willsmer, to East Berlin this week for trade talks with the China National Import & Export Corporation, the purchasing organization for the Peking Government. The company says that this is the result of a direct invitation from the C.N.I.E.C. in Berlin and is in no way connected with the China Trade Committee, which was formed to represent the party of British businessmen who visited Peking in June, 1953, under the auspices of the British Council for the Promotion of International Trade.

Crompton Parkinson sent Mr. H. H. Spencer, M.I.E.E., with the party to Peking but, following a denunciation by Mr. Eden, the Foreign Secretary, of the British Council for the Promotion of International Trade as a "Communist-front organization," the company resigned from that body and subsequently from the China Trade Committee.

The proposed visit of a group of representatives of thirty-five British firms who were to have flown to East Berlin to negotiate with a Chinese trade mission was cancelled last week-end. The cancellation was at the request of the Chinese themselves who stated that they would not be ready to negotiate for some weeks. The British business men cancelled their own bookings and none was cancelled by the Foreign Office.

River Derwent Pollution

In the Chancery Division on 11th March Mr. Justice Harman made an order extending for further periods the suspension of the injunction granted against the Derby Corporation and British Celanese, Ltd. (until 21st December, 1955) and the British Electricity Authority (until 31st October this year) calling upon them to refrain from polluting parts of the River Derwent. Undertakings were given by the defendants with regard to payment for any damage caused by the further suspension.

Kearney Tube Railway

Mr. E. W. Chalmers Kearney, the London consulting engineer, who before the war put forward a proposal for the construction of a Kearney electric tube railway under the Tyne between North and South Shields railway stations, has informed Tynemouth Corporation that the scheme to-day would cost about £1,000,000. A pre-war estimate was £330,000. Tynemouth Corporation has asked South Shields Corporation for its views on the scheme. Before the war the project did not have the full support of the Corporations, who preferred a tunnel carrying both rail and road. The idea was dropped until a few weeks ago when Tynemouth Corporation decided to ask Mr. Kearney for his views on the question of reviving the scheme. Mr. Kearney stated that working expenses would be more than doubled compared with pre-war and an increase in the original proposed fare of 2d would be required.

Gauge and Tool Exhibition

The Gauge and Tool Makers' Association has issued a brochure in English, French and German setting out the general arrangements for the fourth Gauge and Tool Exhibition which will be held from 17th to 28th May at the New Horticultural Hall, Westminster, London, S.W.1.

District Reorganization

The Southern Electricity Board has decided to reorganize the Bracknell, Slough and Staines Districts in its Southall Sub-Area into two new Districts—Maidenhead and Staines. The Maidenhead District will include, broadly, the Slough District and the existing Maidenhead Branch, while the Staines District will take in the remainder of the Bracknell District. The change takes effect as from 1st April.

The South Eastern Electricity Board plans to amalgamate the Croydon and Purley Districts. Until the change is completed, in about two years' time, the Districts will continue to operate separately under the present managers. The combined District will be administered from Electric House, Croydon. The merger is expected to result in substantial economies and avoid the necessity of buying new sites.

Institute of Welding

The spring meeting of the Institute of Welding is being held this year from 28th April to 1st May in South Wales and Bristol. It will open at Porthcawl, Glamorganshire; lectures and a works visit are being organized in South Wales on 29th April, and in the evening members will go on to Bristol.

Further details can be obtained from the Secretary of the Institute, 2, Buckingham Palace Gardens, London, S.W.1.

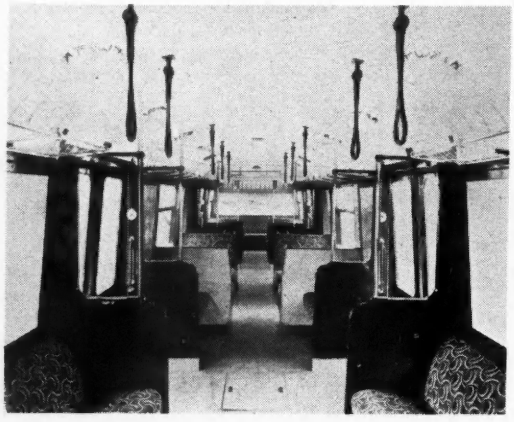
Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £237 0s 0d
Fire Refined 99·70%	ton £236 0s 0d
Fire Refined 99·50%	ton £235 0s 0d
COPPER Tubes ..	lb 2s 4d
Sheet	ton £298 0s 0d
H.C. wire and strip	ton £271 0s 0d
LEAD, English ..	ton £86 5s 0d
Foreign	ton £85 0s 0d
MERCURY	flask £67 10s 0d
TIN, block (English) ..	ton £725 0s 0d
ZINC, G.O.B. Foreign	ton £73 0s 0d
Electrolytic	ton £80 10s 0d
BRASS Tubes (solid drawn)	lb 1s 10½d
Sheet	ton £241 15s 0d
Wire	lb 2s 5½d
PHOSPHOR BRONZE Wire	lb 3s 9d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 16⅛d–16¼d

Relaxation of Australian Restrictions

Our Australian correspondent reports that import restrictions on goods from places outside the dollar area may be virtually abandoned from 1st July next. Even if all controls introduced for exchange conservation purposes early in 1952 are abandoned, however, the import licensing system established to operate them will be retained so that controls can at a later stage be reimposed to correct any dangerous tendencies in Australia's overseas exchange.



Interior of one of the new coaches for the Manchester, Glossop and Hadfield electric suburban route which will go into service in the summer. There will be eight 3-car trains

E.R.A. Luncheon

The British Electrical and Allied Industries Research Association is holding its annual luncheon on 30th April at the Connaught Rooms, Great Queen Street, London, W.C.2.

A.S.E.E. Dinner

The annual dinner and reunion of the Association of Supervising Electrical Engineers will be held on 2nd April at the Connaught Rooms, London, W.C.2. The speakers will include Sir Miles Thomas, chairman of the British Overseas Airways Corporation. Mr. E. A. Bromfield, general secretary, 54, Station Road, New Barnet, Herts., informs us that tickets are now available (£1 1s for members and £1 5s for non-members) and asks that early application should be made.

Illumination Design Course

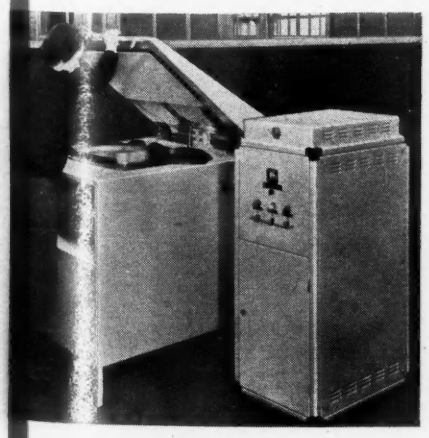
The Spring Illumination Design Course of the Lighting Service Bureau will be held from 27th to 30th April at the Bureau, 2, Savoy Hill, London, W.C.2. Applications for reservations should be made to Mr. E. B. Sawyer, manager of the Bureau.

Australian Mica

Advice is being sought by the Australian Government upon the further development of Australian mica resources. These are found principally in the Northern Territory although there are also deposits in Western Australia. The possibility of profitable exploitation has increased during the past three years, the price of mica having more than doubled in that period.

Vehicle Operation Guide

The "C" Licence Number of *Motor Transport* to be published on 2nd April (price 4d) will be of service to all firms who operate their own transport. It will deal with the organization and maintenance of fleets of vehicles so as to secure maximum efficiency and with the latest methods of costing, upkeep and repair.



Metrovick high frequency equipment welding pockets on plastic raincoats

The S.E. Scotland Electricity Board's exhibition of contemporary cooker design

Cooker Design Exhibition

An exhibition of contemporary electric cooker design was held by the South East Scotland Electricity Board in the Electricity Service Centre, George Street, Edinburgh, from 2nd to 13th March. The exhibition was opened by Sir Norman Duke, chairman of the Board, at a preview held on 1st March. The cookers exhibited were mainly of the automatic type and to give added emphasis to the possibilities of these cookers a demonstration was staged and a meal cooked. The attention of the visitors was drawn to a pence meter which showed that the cost of cooking this meal for four people was just under 2d. Brief details of the exhibition were broadcast in the Scottish News on the day of the preview.

Plastic Welding by Dielectric Heating

The ease and rapidity with which plastic sheet can be welded has commended itself to manufacturers, and radio frequency sealing has completely replaced stitching and other techniques in many factories. It is basically the same as any other form of dielectric heating, and differs only in that the power is concentrated in a small area and is allowed to raise the temperature of the material to fusing point.

The plastic welder type 311W, made by the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, is a 1 kW machine designed for seam welding plastic materials in a single operation. It will cater for a greater variety of applications than previous machines. Up to 2ft of straight seam can be welded in about 3 sec and electrodes can be supplied for any contours such as those needed for the welding of pockets. The generator is supplied as a separate unit, but a self-contained model will shortly be available.

The equipment is completely automatic in operation, the welding cycle being pre-set by process timer. The electrodes are self-aligning and the machine is fully protected against misuse. The welding times or voltage cannot be altered except by operation of a key which can be kept in the possession of a supervisor.

New Zealand's Imports

Compared with the corresponding period of 1952 there was a reduction of about 22 per cent in New Zealand's imports of electrical machinery and apparatus during the first half of last year. The accompanying table gives the values of the chief groups, totalling £5,234,000. The only noteworthy exceptions to the declines were in transformers and convertors and telegraph and telephone apparatus.

Class of Goods	Jan.-June, 1953 £ (000)	Inc.or dec. on Jan.-June, 1952 £ (000)
Batteries and cells	55	— 31
Electrodes and carbons ...	27	— 19
Generators and magnetos ...	310	+ 13
Cable and wire	1,234	— 222
Insulators and parts ...	63	— 45
Lamp bulbs	61	— 98
Lamps (not surgical) ...	170	— 278
Motors under 1 h.p. ...	274	— 96
Ditto, 1–25 h.p.	160	— 34
Ditto, exceeding 25 h.p. ...	78	+ 30
Motor parts, starters, etc. ...	146	+ 1
Electric razors	65	— 18
Telegraph and telephone apparatus	927	+ 127
Transformers and convertors	409	+ 153
Other elec. apparatus ...	982	— 491
Radio apparatus:		
Valves for receiving sets ...	32	— 184
Other valves	14	— 15
Other apparatus	184	— 63
Vacuum cleaners and parts	43	— 100

British Diesel Engines

A new edition of the "British Diesel Engine Catalogue" has been produced, on behalf of the British Internal Combustion Engine Manufacturers' Association, by Temple Press, Ltd., Bowling Green Lane, London, E.C.1, price 52s 6d. Descriptions and tabulated information cover 2,267 engines of 38 makes, the range of power extending from 1·5 to 10,800 b.h.p. In addition to oil engines of all kinds the book includes prime movers capable of working on gas fuels or combinations of oil and gas. Sections of the catalogue are printed in French, Spanish and

Portuguese as well as English, and there is a complete glossary in these languages of the technical terms and abbreviations used.

Refrigerator Sales Aid

Since the control of temperature is the essential feature in every application of refrigeration, Prestcold are emphasizing this fact by supplying thermometers to applicants who fill in coupons carried in advertisements in selected media, or who apply personally at the company's stand at the Ideal Home Exhibition. A nominal charge of 1s is made to ensure bona fide requests.

New E.A.W. Branch

The inaugural meeting of the Bolton Branch of the E.A.W. was held on 25th February, when the chair was taken by Miss N. Kenyon, the speakers including Ald. J. Vickers, Dame Caroline Haslett, and Mr. E. G. Wardle, sub-area manager, North Western Electricity Board. The chairman of the new Branch is Miss E. Mitchell; hon. secretary Miss M. Wilson; and hon. treasurer Mrs. J. P. Rae.

Testing Aircraft Starter Motors

Torque testing equipment made by the City Electrical Co. has been specifically designed to test torque output on aircraft starter motors used on either piston or turbine engines.

For piston engine starters running at comparatively low speeds the equipment incorporates a pony brake of accepted standard pushing down to scales, while, for high-speed turbine starter motors, a step down gear box is inserted between the motor and the brake. A rectifier is included in the apparatus to furnish the various d.c. supplies likely to be required, the main d.c. ammeter, voltmeter and clock being mounted above the rectifier tank.

Another feature of the apparatus is a bench for testing high-speed motors and turbine motor starter panels. It is fitted with an instrument panel complete with main ammeter and voltmeter, clock, coil current ammeter and a h.v. a.c. flash test panel. For tests on starter panels the main contactors are loaded to 500 A d.c. which is obtained from the main rectifier and absorbed by the carbon pile resistors. The supply to the operating coils of the contactor and timing relays is obtained from a small battery which is contained in the bench and has its own charging rectifier and instruments. Lamps at the top of the instrument panel act as resistances in some starter circuits. Tubular gantries on either side of the bench are intended to support spring balances when high-speed motors are being tested.

Torque test rig for aircraft starter motors

Change of Name

Ozonair, Ltd., has changed its name to Ozonair Engineering Co., Ltd.

Trade Announcements

Additions to the outside staff of representatives attached to the London branch office are announced by **Santon, Ltd.** Mr. W. Cleaver, formerly of J. Stone & Co., Ltd., will be responsible for rotary switch sales development, and Mr. J. W. T. Rowell, formerly of Enfield Cables, Ltd., will be representative in the Eastern Electricity Board area. Mr. D. R. Whynes, formerly the representative in the Eastern Electricity Board area, will have special duties in connection with Government and export business.

On 1st April, **H. Cassirer, Ltd.,** is transferring production of all "Lincass" electric household appliances to larger premises at White Hart Yard, Guildford Street, Chertsey, Surrey. From that date "Lincass" products will be distributed by the subsidiary company, Lincass Electric, Ltd., with offices at the new address.

The Nottingham branch of **Albion Electric Stores** is being removed this month to Bancroft's Factory, Roden Street, Nottingham.

Mr. R. F. Cook has been appointed representative for **Ekco-Ensign, Ltd.,** for Kent, and Mr. L. J. Weingard as representative covering part of Manchester and immediate surrounding districts. Mr. Cook will operate from 45, Essex Street, Strand, London, W.C.2, and Mr. Weingard from Kent Street Works, Preston, Lancs.

Wild-Barfield Electric Furnaces, Ltd., informs us that its Belgian associates, S.A. Wild-Barfield, have now moved to 62, Rue Ten Bosch, Brussels, Belgium (telephone: Brussels 47.38.82).

A new depot is shortly being opened by **Aerialite, Ltd.,** at 19a and 19b, Blythswood Street, Glasgow, C.2 (telephone: Central 2299). This will also be the Scottish depot of its subsidiary, **Nettle Accessories, Ltd.**

The northern area organization of **Birlec, Ltd.,** is moving on 25th March to 317, Glossop Road, Sheffield, 10 (telephone: Sheffield 63258–9).

Catalogues and Lists

Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych London, W.C.2.—Illustrated priced leaflet on the new "Hotpoint H30" domestic refrigerator.

John E. Dallas & Sons, Ltd., Clifton Street, London, E.C.2.—Comprehensive catalogue of radio and television accessories, components, aerials and tape recorders.

Gent & Co., Ltd., Faraday Works, Leicester.—"How do you find the time?", an illustrated catalogue of a range of electric clocks (289).

British Manufactured Bearings Co., Ltd., Crawley, Sussex.—Two leaflets on "BMB" pressurized assembly cabinets and bearing handling tools.

Liverpool Electric Cable Co., Ltd., 24, Queen Anne's Gate, London, S.W.1.—Illustrated pamphlet describing the overhead conducting equipment in the Sandhole Colliery, Lancashire.

B.E.N. Patents, Ltd., High Wycombe, Bucks.—Illustrated priced leaflet on the new "Freeflo" paint strainer (CB116).

Black & Decker, Ltd., Harmondsworth, Middx.—Illustrated priced folder covering the company's range of portable electric tools for all industries.

Enfield Cables, Ltd., Brimsdown, Middx.—Two illustrated publications—cable sealing boxes for transformers (EN.207) and braided aerial conductors (EN.206).

Brook Motors, Ltd., Huddersfield.—Illustrated leaflet showing typical examples of electric motors and control gear (782).

Varilectric, Ltd., 10, Melon Road, Peckham, S.E.15.—Illustrated leaflet on the busbar tap-off system, Type "R."

Darwins, Ltd., Tinsley, Sheffield, 9.—Illustrated brochure showing the group's extended range of steels.

Automatic Telephone & Electric Co., Ltd., Strowger Works, Liverpool, 7.—Illustrated folder on "intercom" wall and desk installations (1279).

Elcontrol, Ltd., 10, Wyndham Place, London, W.1.—Illustrated data sheet dealing with the "F.S.M." series of furnace safeguard equipment (10).

Besson & Robinson, Ltd., 6, Government Buildings, Kidbrooke Park Road, London, S.E.3.—Technical folder illustrating the type C.03 a.c. and d.c. contactor (8).

Wilkinson Rubber Linatex, Ltd., Camberley, Surrey.—Two leaflets describing new motor driven and hand operated diaphragm pumps.

Dewhurst & Partner, Ltd., Inverness Works, Hounslow.—Illustrated catalogue of "Dupar" multi-motor panels and automatic starting equipment.

Hendrey Relays, Ltd., Bath Road, Slough, Bucks.—Eight pages on relays and flameproof switches for inclusion in the company's catalogue.

Musgrave & Co., Ltd., St. Ann's Works, Belfast.—Leaflet relating to the type "N" fan.

SERVO-MECHANISMS

New Performance Criterion: Remote Position Control

TWO papers dealing with the performance of servo-mechanism systems were presented on Tuesday before the Measurements Section of the Institution of Electrical Engineers. One by Dr. J. H. Westcott (Imperial College of Science and Technology) described a new performance criterion based upon minimizing the time-moment of error-squared of a system in response to a signal. The purpose of the author was to show that such a criterion gave better practical results than did the minimum integral of an error-squared system. He recommended the adoption of a time-weighted criterion for the design of the modern special purpose system where the original empirical requirements were not necessarily appropriate.

The new criterion designated as the best that system which minimized the time-moment of error-squared in its response to any specified input signal. It was thus based upon the complete error in the transient response of the system to a desired input signal. The criterion was an attempt to place servo-mechanism design upon a more general logical basis, corresponding in straightforward cases to the empirical design instructions normally employed, but without suffering from the difficulties of interpretation in special and unusual cases. It enabled a comprehensive figure of merit to be determined for the performance of systems otherwise quite different in detail, and enabled their performance to be assessed and compared in relation to any specified input signals.

The ultimate decision of what constituted good performance was based on human judgment or even personal opinion. There were innumerable special cases, and in some of these the final result was in the nature of a "hit or a miss," when the decision was easily made as to whether one system was better than another. It was not possible in a general way to legislate for all cases, and the field had to be narrowed. For the purposes of the paper the "hit-and-miss" cases and the special penalty cases (e.g., catastrophic if more than 10 per cent overshoot occurred) were set aside, and attention was concentrated on the most usual one where the degree of following (or regulating) was important at every instant, so that the complete error response was of concern. A further point which was emphasized was that the problem of following must be viewed from a standpoint different from the mathematical one of being given a curve and asked to find a simpler curve that approximated to it as closely as possible. The problem was an engineering one and was essentially concerned with the nature of the mechanism that was doing the following (or regulating). A fundamental property of all controllable sources of power was the necessity to store energy as well as to supply it; e.g., for motors it was stored owing to the inertia of the armature and the inductance of the field winding. The problem, then, might be stated thus: given a system containing unavoidable inertia delays, by what measure of its errors might the quality of its performance best be decided?

As a simple example, a remote-position-control servo-mechanism whose velocity-error constant was taken as the sole design parameter was considered. This constant would be determined first, in order to minimize the integral of error-squared, and then to minimize the time-moment of error-squared, when the input signal was a step-function displacement. The example provided a direct comparison between the responses of the two systems in such a way that the effect of time weighting was clearly brought out, and also enabled the method of deriving the standard integral forms, required for the use of these criteria, to be described. The servo-mechanism depicted consisted of a simple Ward-Leonard set driving an inertia load. The generator had a split field fed differentially by a valve amplifier whose gain was adjustable; this constituted the design parameter. The system contained two exponential time-constants of delay, one being the field time-constant of the generator, the other being the mechanical time-constant of the servo-motor and its load.

An advantage of algebraic methods of analysis was the generality of the relationships obtained. An expression in the paper gave the condition for W to be a minimum for any ratio of time-constants of the system and it was quite easy to find how the minimum value of W varied with the ratio of time-constants. A form of the graph confirmed what had become an accepted rule of practice; i.e., when any choice of time-constants was permissible an advantage in performance would be obtained if they were selected with as wide a spacing as possible. Thus, as the ratio of time-constants increased, the minimum value of W was reduced and the gain for a minimum was increased.

It was proposed to illustrate the use of the W-criterion in a more extended example employing stabilizing means to show that the practical validity of the criterion did not depend upon the particular case. As before, the input signal was taken as a step-function displacement and this was chosen because designers had greater familiarity with the response of systems to this transient signal than to any other. It should be noted, however, that the criterion was not limited in its application to this particular input, but was applicable to the solution of the optimum system parameters for any arbitrary input signal. Having chosen a step-function input it was then necessary to select the most suitable form of stabilizing device, and the choice laid between the use of a cascaded network in the error channel or output derivative feedback with or without a feedback network. One advantage of the use of the W-criterion was that as soon as the optimum values of the parameters had been determined the work was complete, since the nature of the W-criterion guaranteed that the transient response would be satisfactory.

Remote Control with Non-Linear Characteristics

In the second paper, Dr. J. C. West and Mr. P. N. Nikiforuk gave particulars of an investigation into the behaviour of a remote-position-control servo-mechanism with "hard-spring" non-linear characteristics, in which the ratio of output to input increased with the input. Results with some theoretical verification were given for transient and steady-state-frequency responses under various operating conditions. The investigation was limited to a particular three line characteristic and about 30 sets of frequency responses using three degrees of non-linearity and three degrees of damping were taken. The predicted and experimental jump frequencies, together with the degree of non-linearity, the degree of damping,

and the peak value of the input voltage used for each response were given in tabular form.

Typical frequency-response curves showed that the frequency bandwidth increased with an increase of the amplitude of the input signal or with an increase of non-linear gain, and that for ascending frequencies the frequency responses of the non-linear simulator coincided with those of the linear simulator at low frequencies, and at frequencies equal to, and greater than, the jump frequency. The frequency at which the response of the non-linear simulator departed from that of the linear simulator decreased with an increase of the amplitude of the input signal. For descending frequencies the responses of the non-linear simulator coincided with those of the linear simulator for frequencies greater than the jump frequency. For frequencies less than the jump frequency the responses for descending frequencies coincided with those for ascending frequencies.

These experimental observations agreed with the theoretical predictions. In a very few cases the response of the non-linear simulator immediately after the discontinuous jump for ascending frequencies did not coincide with the linear responses at the same frequency. The two responses did not coincide until the frequency of the sinusoidal input was somewhat greater than the jump frequency. The reason for this was that, under certain conditions of damping and amplitude of the input signal, the operating condition of the non-linear simulator immediately after the jump was determined by an intersection that occurred along the knee of the modified describing function.

When the amplitude of the input signal was large, jumps characteristic of a soft-spring system occurred in the output signal in addition to those characteristic of the hard-spring system. For descending frequencies the latter occurred first, but for ascending frequencies the reverse was true. Sometimes the jumps characteristic of soft-spring systems occurred only for ascending frequencies, and sometimes only for descending frequencies. These jumps were due to saturation in the non-linear element.

The phase response of a simulator with either a hard- or a soft-spring characteristic could be predicted by equation and the appropriate family of ellipses and modified describing functions. A jump in the phase response must be predicted to occur at the same frequency as that in the amplitude of the output signal.

The theoretical work and verification of the transient behaviour was considered to be of great importance, but only experimental results were given, it being a long and complex problem which was being investigated independently.

The effect of the non-linearity on the transient responses to step-displacement inputs was shown, and the rise time for the non-linear simulator was smaller than that for the linear simulator. The initial overshoot for the non-linear simulator was greater than that for the linear simulator, but the settling time was smaller.

The theoretical relationship between three of the four variables might be displayed as a two-dimensional line drawing showing closed curves for selected values of one of the variables. The fourth variable might be considered to be a parameter, fixed for any one set of closed curves, but it was best to consider the damping to be fixed for any one set of curves.

ELECTRICAL RESEARCH REPORTS

AT the meetings of the I.E.C. Technical Committee (No. 31) held in London last year some delegates questioned the general applicability of the data obtained by the use of a spherical vessel in the determination of safe flange gaps, and the chairman invited the British delegation to discuss the following points which summarized those raised in the discussion:—

(1) The probable effect of using test vessels other than spheres and of using different shaped vessels partly filled with equipment to simulate practical conditions.

(2) Whether the one-in-a-million chance accepted as the greatest risk with spheres could, on the basis of present knowledge, also be associated with other shapes.

(3) The effect of using test vessels equal in volume to the size of the enclosures in service—for example, would the dispersal of results produce curves similar to those found with the 8-litre test spheres?

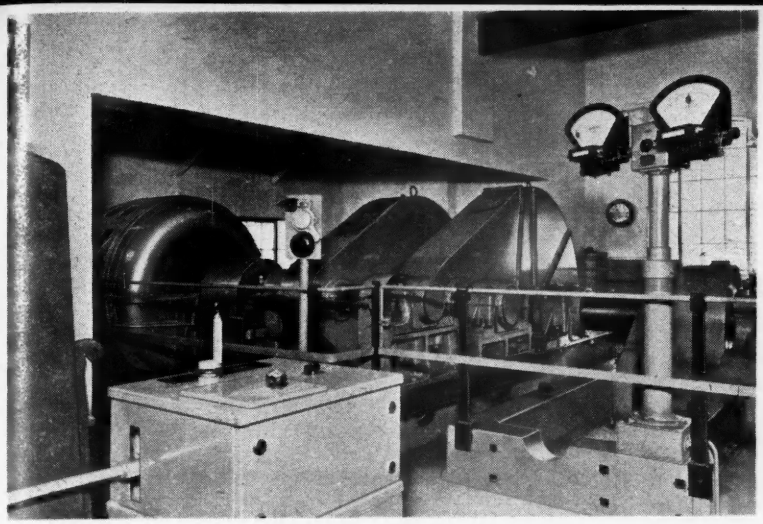
A search has now been made through the available E.R.A. reports, and other published papers, and a summary of the results is given in Report Ref. G/T289, "Flameproof Enclosures—Effect of Size and Shape of Enclosure on the Maximum Experimental Safe Gap," by C. E. R. Bruce, D.Sc., M.I.E.E., which has recently been issued at 6s by the British Electrical and Allied Industries Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Among other recently published works of the E.R.A., Report Ref. Z/T94, "Research into the Properties of the Hydrogen-Oxygen Cell," by F. T. Bacon, M.A., A.M.I. Mech.E. (price 10s 6d), continues the work described in Ref. Z/T81 to the stage where the difficult problem of corrosion of the electrodes is nearly solved. Other problems to be investigated are listed and a brief review is made of possible applications of the cell in industry.

In Report Ref. F/T180, "Development of a Specification for a Discharge ('Ozone') Resistance Test for Rubber Insulated Cables," which is available at 7s 6d, a description is given of an investigation which has been carried out to develop a type test for discharge ("ozone") resistance of rubber insulated cables for electric power and lighting for inclusion in a revision of B.S. 7. It was agreed that this test should be developed on the general lines of that prescribed in B.S. E.20: "High Tension Ignition Cables for Aircraft Engines," i.e. a test voltage would be applied between the conductor of the cable (stripped of its outer protective coverings) and a suitable external electrode so as to produce a layer of corona discharge at the surface of the rubber insulation.

In the test included in B.S. E.20 several turns of the cable are wound on a wooden mandrel which is then inserted in a brass tube so as to leave a small air gap between the tube and the rubber. A voltage 25 per cent in excess of the rated voltage of the cable is then applied for four hours between the tube and the cable conductor. It is required that no breakdown or visible damage to the rubber shall occur in that time. Consideration is given to the modifications which are required to make such a test appropriate to the type of cable and range of sizes covered by B.S. 7.

B.S. 833 proposes that the magnitude of the ignition interference field should not exceed 50 μV/metre when measured under certain defined conditions and with field strength measuring equipment having specified characteristics. Joseph Lucas, Ltd., and the E.R.A. have made measurements on a large number of motor vehicles and the results of these measurements are summarized in Report Ref. U/T123, "The Magnitude of the Radio Interference in the Television Band from Ignition Systems of Motor Vehicles," by A. H. Ball and W. Nethercot (price 6s), which assesses the position relative to the B.S. level of tolerable interference, and also shows what degree of suppression is required for compliance with the requirements of B.S. 833.



Dynamic Braking Equipment

Large Coalfield Slant Haulage System

THE largest a.c. slant haulage in the South Wales coalfield to be equipped with dynamic braking has recently been commissioned at Pantyffynnon Colliery, near Ammanford. The winder drum of the original haulage, which was formerly operated by a reciprocating steam engine, has been retained, and is now driven through reduction gearing by a reversible a.c. slipring motor rated at 700 h.p. r.m.s. The electrical plant and control gear for the new drive was supplied by the General Electric Co., Ltd.

The length of the Pantyffynnon haulage is 1,000 yd over gradients ranging from 1 : 2·1 to 1 : 5·5, and the maximum load comprises 11 trams with a total dead weight of 17 tons. The normal duty cycle provides for seven journeys an hour at a maximum rope speed of 12½ m.p.h., representing a total of 475 tons of coal raised per 8-hour shift. When used for man riding, the maximum rope speed is limited to 6¼ m.p.h.

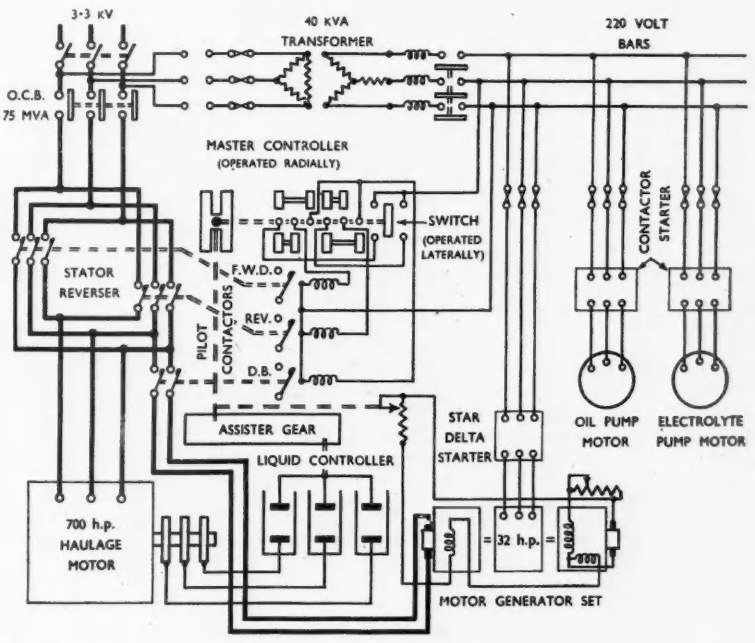
The electrical plant comprises the main haulage motor, a motor-generator set which provides d.c. for dynamic braking, and two 220 V motors which drive the assister gear and electrolyte pumps for the liquid controller.

The main switchgear consists of a two-cubicle 3·3 kV switchboard fitted with a 75 MVA oil circuit breaker for controlling the supply to the winder motor; and h.r.c. fuses for limiting the supply to the 40 kVA auxiliary transformer. The 220 V secondary of this transformer feeds a fuse type l.v. distribution board. The control gear for the winder motor consists of a stator reverser and a weir type liquid controller with a continuous dissipation of 250 h.p. The motor driving the m.g. set is provided with a star-delta starter, but the other auxiliary drives are equipped with direct-on-line contactor starters.

The main haulage motor is a 3·3 kV reversible slipring machine of the screen-protected type rated at 700 h.p. at 365 r.p.m., and is fitted with two pedestal journal bearings. The three-machine m.g. set for dynamic braking comprises a 32 h.p. 220 V induction motor direct-coupled to a 20 kW main exciter and a pilot exciter.

The 3·3 kV switchboard has independent air-break isolators for the haulage motor and the auxiliary transformer. The stator reverser is of the air-break type with sections for forward and reverse winding and dynamic braking. It is electrically operated and fitted with interlocks to prevent the simultaneous closing of the forward and reverse or dynamic braking contactors, and to ensure that the arc is completely cleared before the next switching operation is carried out.

The liquid controller is of the electrode weir type in which the moving electrodes form a weir to retain or release the electrolyte in the three insulated electrode chambers. Electrolyte is pumped from a lower compartment into a common header which feeds the electrode chambers. An oil-operated servo unit is employed for operating the liquid controller, and also for determining the rate of acceleration of the electrode movement, and consequently of the haulage motor.



The winder house at Pantyffynnon Colliery with the driver's control desk in the foreground is shown above and a simplified schematic diagram of connections for the a.c. slant haulage installation on the right

The servo unit consists of a fixed piston with a moving cylinder which carries a toothed rack. This rack engages with a quadrant, which is connected to the lever operating the controller. The unit controls the rate of acceleration, and co-ordinates rotor resistance with excitation during dynamic braking. When starting, it is only necessary for the driver to move the control lever to the full-on position, and the servo unit automatically takes care of the rate at which the rotor resistance is cut out.

The cam type master controller is mounted in the control unit. Discriminating back-out switches are incorporated which can be operated by a knob on the top of the control unit. An emergency stop push-button and a man/coal switch for setting the appropriate overspeed tripping are also mounted in the top of this unit. The auxiliary control gear for the stator reverser and the dynamic braking system is housed in a sheet steel cubicle.

Method of Operation

The driver's control lever operates in an H gate; when it is in the neutral position movement to the left energizes the appropriate contacts in the master controller for forward winding and dynamic braking. On moving the lever forward from neutral the appropriate a.c. stator contactors are closed and the winder motor accelerates, at a rate determined by the servo mechanism of the liquid controller, to a speed which is fixed by the position of the control lever. Movement of the control lever backwards from neutral disconnects the stator of the haulage motor from the 3·3 kV supply and connects one phase of the stator winding to the d.c. supply from the dynamic braking m.g. set. The degree of braking is then controlled by the position of the control lever, which is mechanically coupled to the dynamic braking regulator.

Similarly when the control lever is moved from neutral to the right, the master controller contacts for reverse winding and dynamic braking are energized, and backward movement of the control lever causes the motor to accelerate in the reverse direction, while a forward movement applies the dynamic braking.

Overspeed tripping is related to the coal and man limits by a two-range relay which operates in conjunction with a tacho-generator mechanically coupled to the haulage motor. Operation of the man/coal switch on the driver's control desk automatically selects the appropriate relay range of 6¼ m.p.h. maximum for men or 12½ m.p.h. maximum for coal. Different decking levels are used for man riding and coal hauling, and the overwind limit switches which are fitted in each of these positions are also correctly related by the man/coal switch on the control desk. The scheme includes the usual features of control and interlocking as applied to haulages.

Acknowledgment is due to the National Coal Board for permission to publish this description.

Magnetic Field Calculations

THE axial and radial components of the magnetic field at any point in space of a cylindrical or an annular coil carrying an electric current are given in a 29 page publication entitled "Magnetic Fields of Cylindrical and Annular Coils," which has just been issued as No. 38 of the American National Bureau of Standards Applied Mathematics Series. The results are expressed in terms of complete elliptic integrals or of Legendre functions which involve ratios of the significant dimensions of the coils.

In experimental work it is frequently necessary to produce an accurately known magnetic field, and the use of one or more solenoidal coils of measurable dimensions is usually the most convenient way of accomplishing this. Possible applications range from the laying-out of large current-limiting reactors in electric power stations to the design of coils for studying paramagnetic resonance in atomic nuclei. Copies of this booklet are available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., price 25 cents. Foreign remittances must be in U.S. exchange and should include an additional one-third of the publication price to cover mailing costs.

I.E.E. North-Western Centre

ON 9th March the North-Western Centre of the Institution of Electrical Engineers held its annual dinner at the Midland Hotel, Manchester. Proposing the toast "The Institution," Sir Robert A. Burrows, K.B.E., J.P., deputy chairman, District Bank, Ltd., paid tribute to the late Sir Leonard Pearce, who was chairman of the Centre 50 years ago. Since that time, he said, there had been many changes in the electrical industry and he referred particularly to the development of mining electrical machinery. In conclusion Sir Robert congratulated the President of the Institution, Mr. H. Bishop, on the way in which the B.B.C. had handled the sound and television broadcasts of the Coronation.

The President, responding, said that the number of graduates coming into the Institution was decreasing, and this might have serious consequences. Obviously we were not expanding in quite the way we should and this limited our technical achievements. There were many unfilled places in the technical colleges and universities. We were getting neither the right quantity of men nor those of the requisite quality. Mr. Bishop was convinced that we were entering, or had entered, a great age of electronics and it was having a major impact on our life. We must, therefore, do our best to train our engineers and we must not be too limited in outlook. The I.E.E. could help in this direction by keeping in the closest possible touch with education, training, research and industry.

The Centre chairman, Mr. H. West, proposed the toast of the guests, the response being made by Dr. P. F. R. Venables, principal, Royal Technical College, Salford, who said he recently had the opportunity of discussing with the I.E.E. the subject of "sandwich" courses and nowhere had he found a more ready appreciation of the problems of modern engineering education. As a principal of a college he was very pleased with the work which the I.E.E. was doing in this direction in co-operation with the Institutions of Civil and Mechanical Engineers.

Irish Rural Progress

THE Irish Electricity Supply Board last week celebrated the connection of the 100,000th consumer under its rural electrification scheme. This consumer was a large co-operative concern in a village in the foothills of the Knockmealdown Mountains in Co. Waterford. The premises were floodlit and the proceedings were televised from the upper floor to an overflow audience on the lower floor, the television apparatus having been flown over from the Pye factory at Cambridge.

Mr. S. F. Lemass, Minister for Industry and Commerce, reviewed the progress of the scheme since it was begun in 1947 and said that 40 per cent was now finished. The completion would take another five or six years. He was glad to see that the farmers welcomed the electricity supply and to note that consumption was increasing in the rural areas already connected.

Mr. R. F. Browne, chairman of the Board, said there were now 1,800 men employed on the rural development, in which £2,500,000 was being invested annually. It was noteworthy that the rate of consumption in many of the rural areas was increasing more rapidly than in the cities.

Engineering in Europe

Abstracts from Foreign Technical Journals

IT is interesting that there is still a school of thought believing that circuit *making* may set up dangerous switching surges, although this is contradicted by the bulk of the experience available. The author therefore investigates the problem in the simplest way by considering the travelling waves set up at either side of the circuit breaker rather than the oscillations, their reflections at the busbars and the superimposition of the reflected on the direct waves. It is seen that in the most unfavourable case the over-voltage factor is 2 and the gradient per microsecond equal to the voltage rating. These results refer to single-phase conditions, but help to solve the more involved problem of three-phase conditions. For the latter the dynamic surges may *theoretically* rise to 2·5 times the phase voltage, but service experiences as well as laboratory tests in the most unfavourable conditions show that even 2 U_{ph} is never reached; thus neither transformers nor motors are actually endangered.

The case of opening surges cannot be considered by travelling waves because actually the system oscillations, of which there are three stages, constitute the danger here, viz., those set up by the arc ignition and maintained by the negative arc characteristic; the second stage is the system oscillations caused by the rupture of the current; and the third the disturbances due to re-ignitions. These phenomena can be studied on appropriate equivalent circuits.

The detailed analysis of various typical cases shows that in the most unfavourable cases the over-voltage factors of the order of 4–5 may be doubled between phases in systems with isolated neutral. Probably these cases produce most accidents in service. The circuit breaker type and mode of operation play an important role in this and the use of air- and gas-blast breakers and earthing of neutrals are among the most efficient means of preventing switching surges.—" Physical Mechanism and Characteristics of Switching Surges in Inductive Circuits. Means for Preventing Them," M. S. Teszner, *Bull. Soc. Franc. Elect.*, 7th Series, Vol. 3, pp. 708–718, No. 35, 1953, in French.

Overhead Line Vibration

" Galloping " of overhead line conductors is a phenomenon differing from the better-known vibrations of the conductors set up by wind eddies on the leeward side of the conductor when steady non-turbulent winds blow across the line. The vibrations have frequencies from 15 to 100 c/s and their amplitudes are usually of the order of 3–10 mm, with 30–50 as a maximum. The frequencies of the galloping, which is due to strong and gusty winds, are much lower, but the amplitudes may reach 3–6 m, and even 10 m.

The author presents the results of the evaluation of observations extending over six years and mostly obtained cinematographically. Although the analysis of these data did not yield a concrete and exact theory of the phenomenon, the relations between wind speed and direction and the character of the oscillations become much clearer, and also the influence of ice loads, lengths of spans and type of conductor suspension on the severity and duration of these dangerous vibrations. (Longest duration recorded three days.) Cases of superimposition of " ordinary " and " galloping " vibrations were also observed in which it was quite obvious that the small superimposed vibrations were not harmonics of the galloping " fundamental " frequency.

In other cases travelling waves were superimposed on standing waves. The regions in which galloping conductors were observed most frequently were, rather surprisingly, those of the southern republics of the U.S.S.R., including the Urals and the Caucasus. A tentative interpretation of the influence of the local topography is also presented, and some recommendations are made for the reduction and, possibly, elimination of this dangerous phenomenon.—" Galloping of Overhead Line Conductors," E. P. Mironov, *Elektrichestvo*, No. 11, pp. 25–32, 1953, in Russian.

Tracking Currents and Arcing

The problem of tracking currents on insulators is of fairly recent date, which is understandable, because it could not arise before plastic insulating materials were introduced. While the results of the tracking process are unmistakable, the multiplicity of factors influencing the occurrence of tracking renders it difficult to establish general criteria and testing methods of unambiguous significance for the tracking strength of materials and the many testing methods existing are often discussed and even more often criticized. Every single one has its merits in a strictly limited range, but none of them is suitable for all purposes and materials or even suitable as a basis of a standard method of general validity (which might be obtained by combination with the more valuable features of certain other methods).

So far, the supervising bodies in various countries recommend actually parallel, or successive, tests by the three most reliable methods, i.e., the drop and submersion and vapour tests, although with deviations in certain details, so that comparison of the results is still difficult. The author puts forward the idea of combining a more recent method, the initial spark test, with one of the known methods of testing arcing resistance (carbon-arc fusion or A.S.T.M. methods), with a view to creating a generally useful standard testing method. This could only be achieved by the simultaneous evolution of a fool-proof classification system for plastics from the tracking and arcing resistance aspects.

The author indicates his ideas in this respect and succeeds in demonstrating at least the possibility of solving the problem in this way, although this would require concerted efforts by many interested organizations and would thus take a comparatively long time.—" Resistance to Tracking Currents and to Arcing. Comparative Evaluation of Practical Experience," E. Wandeberg, *Kunststoffe*, Vol. 43, No. 7, pp. 254–260, 1953, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

X-Ray Therapy

Experience with 8 MeV Linear Accelerator

AN account of a new type of linear accelerator for X-ray therapy recently installed at a Hammersmith Hospital was given by Mr. C. W. Miller (Metropolitan-Vickers) in a paper presented last week at the Institution of Electrical Engineers. This machine, it was stated, produced 8 MeV rays and had a stabilized output, after filtration, of 200 Röntgen/min at one metre. The electrons were accelerated by a 3-metre length of corrugated waveguide energized by a magnetron giving a pulsed output of 2 MW (peak) at a free-space wavelength of 10 cm. The axis of the accelerating unit being horizontal, the electron beam was deflected through a right angle by a rotatable system which varied its direction. Agreement between measured and calculated performance was shown to be satisfactory. A description of this equipment and also the 45in cyclotron which is being built at Hammersmith was published in the *Electrical Review*, 23rd October, 1953, page 963.

DISCUSSION

Opening the discussion, Mr. D. W. Fry (A.E.R.E., Harwell) said the form of h.v. generator described had not been discussed before at a meeting of the Institution. The considerable amount of development work carried out while the accelerator was being built for clinical use had led to complications not essential in its final use. In normal operation when the output was about 400 Röntgen/min, the actual power in the beam was of the order of 240 kW, which agreed closely with the original design figure for that loading of 10–12 per cent of the r.f. power being fed into the system. Subsequent experience had shown that this beam conversion efficiency could be as high as 40 per cent.

Mr. G. R. Newbery (Hammersmith Hospital) paid a tribute to the collaboration between an industrial firm and two Government establishments in the development of the machine. They had been extremely satisfied with it. Since the beginning of treatment in September last 100 patients had received 2,000 treatments and on every occasion the prescribed dose could be given. A technician ran the machine up each morning and checked it, which took ten minutes, after which it was transferred to the radiographer. The r.f. power generator was now switched off between treatments, except when very accurate measurements had to be made. The magnetron took about a minute to settle down to its final frequency.

The large magnetrons had behaved extremely well, a life of over 1,100 hours having already been obtained from one and 200 from the other. The ignitrons in the r.f. generator system had not been quite so satisfactory, but by increasing the striker current the position had improved, and average lives of 100 to 200 hours were now being obtained. The trouble had been not "firing through" but failure of the ignitrons to strike when the striking voltage was applied. Of the other valves, numbering just over 100, 34 had been replaced, 10 being in a small mercury thyratron. All the valves since the machine came to the Hammersmith Hospital, however, had been on for 2,500 hours, and most of them had been in use for a year or two before that, in the factory.

They looked forward to the 4 MeV machine which the author mentioned, which should be simpler and more compact and thus ideal for super-voltage X-ray therapy.

Mr. M. G. Kelliher (Mullard Electronic Research Lab.) said that while the feedback system did not require frequency stabilization of the r.f. source, it still left a fairly frequency-sensitive system. The production of higher energies would involve the use of two or more guides similar to that described. He showed by a slide how from the first 3-metre guide the electrons, already bunched, were injected into the second. Two 3-metre guides in series of the same impedance did not increase the frequency sensitivity of the system, because the phase could be corrected half-way.

This principle had been embodied in a machine giving 12–13 MeV, in which the "rat-race" in the author's machine had been replaced by a circular waveguide with four arms. The powers to be combined were fed in the two arms at right-angles and propagated in the circular waveguide. If these powers were equal and suitably phased, a third arm at 45 deg to the first two could be used to withdraw the sum total of the power. If unequal, by suitably rotating the second pair of arms relatively to the first additional ratios up to five could be produced. Thus no unity feedback ratio was needed.

Mr. W. Walkinshaw explained the development of an accurate theory for the design of the corrugated waveguide, which agreed with experiment. The next stage was to adjust the phase velocity to accelerate the particles at the right speed by altering the depth of the corrugation.

Dr. F. T. Farmer emphasized the importance of keeping the electron beam centred on the target, which was not easy on a 5-mm circle. At Newcastle an ionizing chamber was fitted in the X-ray beam consisting of a cylinder divided into four quadrants, each feeding a d.c. amplifier. The quadrants were connected in opposite pairs and the amplifiers controlling the current through deflector coils held the beam accurately in the centre. To provide very accurate stabilization, a servo-mechanism might control the focal spot.

Elongated Electron Beam

Mr. G. Saxon (Metro-Vick) said that, with the rotating type of X-ray head, the electron beam no longer possessed circular symmetry, being elongated due to the finite spectrum width. This and other difficulties could be largely overcome by electron collimation before the target, as had been done with the 4 MeV accelerator at the Christie Hospital, Manchester. This method reduced the width of the penumbra end of the X-ray field; also the collimator could be made of a more readily available material than uranium. For an accelerator of given frequency tolerance more power could be put into the beam without feedback than with feedback when bridge ratios of about unity were used. For X-ray treatment, where high energy in a short length, resulting in less than maximum power from the beam, was the primary requirement, it seemed that feedback should be used but not where high beam power was required.

Mr. M. C. Crowley-Milling referred to the difficulty of maintaining close waveguide tolerances while the sections were being brazed, when the temperature caused the high-conductivity copper to be deformed under its own weight. In subsequent machines clamping the individual sections together had proved adequate by employing a stronger material than soft copper, such as chromium copper, which was four or five times stronger than pure copper and had only slightly higher resistivity.

The author, in reply, showed a number of slides to illustrate the greater simplicity provided in subsequent developments.

Toasters and Mixers

TWO items of food preparation equipment are dealt with in this, the latest of our series of surveys of domestic electrical equipment. Toasters have been steadily gaining in popularity as more people have learnt to appreciate the added convenience, economy and improved finished products resulting from their use as compared with the cruder methods of toasting under the grill or in front of the fire.

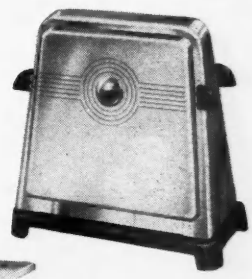
The fact that the toaster can be used on the dining table largely eliminates the possibility of burning, but for completely foolproof operation there are a number of automatic types which besides ejecting the toast when it is cooked and switching off the electricity, also provide any desired degree of brownness. It should be borne in mind, however, that while all the non-automatic types are suitable for a.c. or d.c., some of the automatic models can be used only on a.c.

There is probably no domestic electrical appliance of greater all-round utility to the housewife than the mixer. From its name one would not gather that besides mixing it will whip, beat, cream, whisk, stir and blend as well as in some cases, with suitable attachments, knead dough, mince, sieve, slice, shred and peel vegetables, extract juice, open cans, grind coffee, nuts, etc. Unfortunately this apparatus is for some reason or other deemed to be in the semi-luxury class and so bears a 50 per cent purchase tax. This brings the price of most full-sized machines to £20 or more, though there are drink and semi-solid mixers and also one portable food mixer (without stand and bowl) selling below £10.

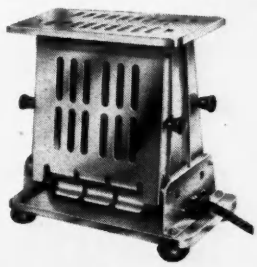
TOASTERS

Manufacturer	A.B. Metal Products	Bulpitt & Sons	Dualit				Easipower
Name or model	"Clem"	950	147	"Triple"	"Auto-3"	"Auto-6"	—
Type	Non-automatic, 2 slice	Non-automatic, 2 slice	Non-automatic, 2 slice	Semi-automatic, 3 slice, a.c./d.c.	Automatic, 3 slice, a.c./d.c.	Automatic, 6 slice, a.c./d.c.	Non-automatic, 1 slice, double side
Loading	650 W	500 W	550 W	1,500 W	1,500 W	3,000 W	600 W
Special features	—	Fixed crumb tray	Turn-over type	Push-button toast ejection and switching off	Electric clock movement, indicator lamp	Electric clock movement, indicator lamp	—
Finish	Black and chromium	Light bronze, black base, chromium top	Chromium	Chromium	Chromium	Chromium	Chromium with black plastic feet
Price	£2 9 6	£1 12 6	£2 5 0	£5 5 0	£10 10 0	£19 19 0	£2 7 6

Manufacturer	Falk, Stadelmann	G.E.C.		
Name or model	95625 Robot	D5620	D5605A	D5625
Type	Automatic, 2 slice, a.c./d.c.	Non-automatic, 2 slice	Non-automatic, 2 slice	Automatic, 2 slice, a.c. only
Loading	1,200 W	600 W	600 W	1,250 W
Special features	Thermostatically compensated clockwork timing device	Turn-over doors	Turn-over doors	Automatic toast raising and switching off
Finish	Chromium	Chromium	Polished aluminium	Chromium
Price	£5 19 6	£3 15 0	£2 2 0	£5 5 0



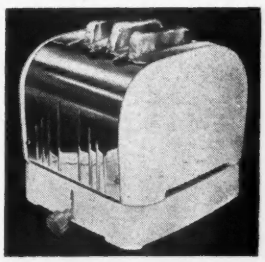
Above: G.E.C. D5620



Left: G.E.C. D5605A

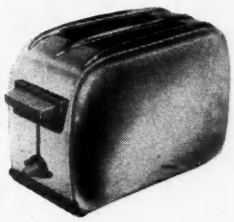
Below: G.E.C. D5625

A.B. Metal Products "Clem"

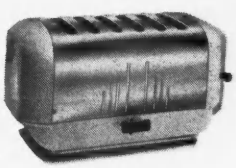


Dualit "Triple"

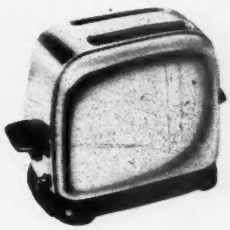
Dualit "Auto-6"



Falk, Stadelmann



Bulpitt 950

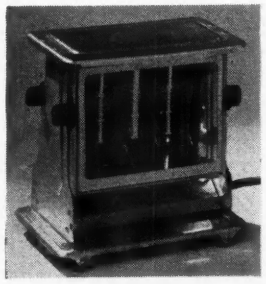


TOASTERS . . . . . *continued*

Manufacturer	H.M.V.		L. G. Hawkins	Homefyre	Hotpoint
Name or model	TH1	TU1	—	119	80854
Type	Non-automatic, 2 slice horizontal	Non-automatic, 2 slice	Non-automatic, 2 slice	Non-automatic, 2 slice	Non-automatic, 2 slice
Loading	750 W	750 W	525 W	550 W	600 W
Special features	Large toasting area, lid forms rack	Turn-over doors	Turn-over doors	Turn-over doors	Glass sided turn-over doors
Finish	Primrose and black	Primrose and black	Chromium and Bakelite	Nickel or chromium	Stainless polished metal
Price	£3 10 0	£3 0 0	£2 2 6	On application	£2 15 0

Manufacturer	Morphy-Richards		Ormond	Premier	
Name or model	TA/1B	TA/1B	—	916	918
Type	Automatic, 2 slice, a.c. only	Automatic, 2 slice, a.c. only	Non-automatic, 2 slice	Non-automatic	Non-automatic
Loading	1,250 W	1,250 W	600 W	600 W	600 W
Special features	6 position browning control and trip switch	6 position browning control and trip switch	Turn-over doors	Turn-over doors	Turn-over doors
Finish	Primrose or beige stove enamel body, black plastic fittings	Chromium plated body with black plastic fittings	Chromium and cream Bakelite	Polished alloy	Chromium plate
Price	£4 19 6	£5 5 0	£1 17 6	£2 5 0	£2 15 0

Manufacturer	T. Price & Son	Telsen	Vidor
Name or model	2054	1138	CN788
Type	Non-automatic, 2 slice	Non-automatic, 2 slice	Non-automatic, 2 slice
Loading	450 W	400 W	600 W
Special features	Detachable rack	—	Turn-over doors
Finish	Nickel plate	Nickel plated	Chromium
Price	£0 19 11	£1 10 0	£1 17 6

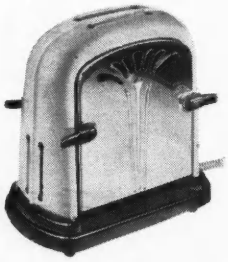


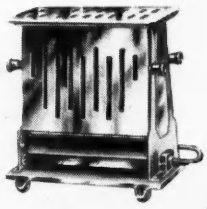
Above: Hotpoint 80854

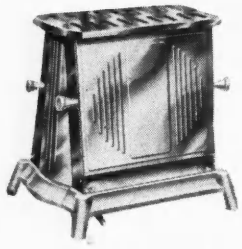
Left: Premier 916

Below: Morphy-Richards TA/1B

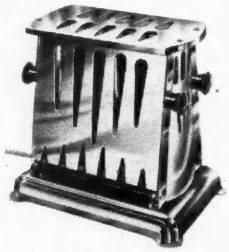
H.M.V. (left) "TH1" horizontal and (right) "TU1" vertical





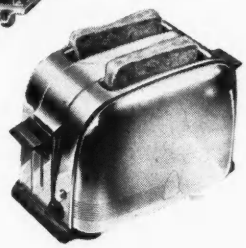


Ormond non-automatic

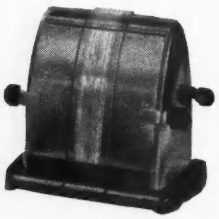


Vidor CN788

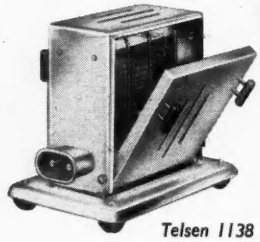
Above: Siroma food mixer



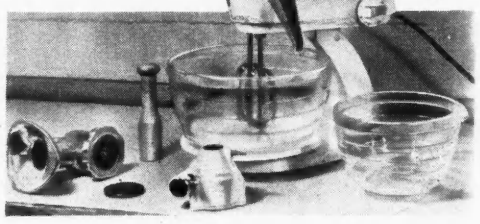
Below: English Electric mixer



L. G. Hawkins 2 slice



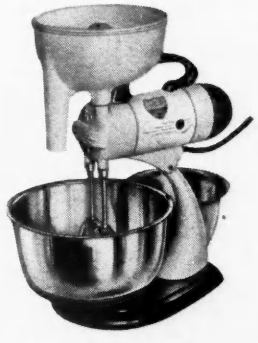
Telsen 1138



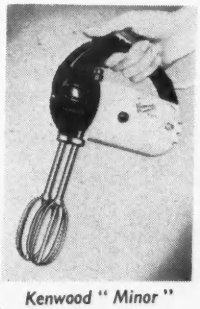
MIXERS

Manufacturer	Brown Brothers ("Duco")	Churn Co.	English Electric	Falk, Stadelmann	Howard Foss
Name or model	—	"Denamix"	5500	95643	Pulverizer
Capacity	5–6 pint	1 quart	5 pint	4½ pint	2 pint
Standard equipment	Twin beaters, juice extractor and two mixing bowls	Wire whisk, disc whisk	5 and 2 pint bowls	Beater, juice extractor and two bowls	Two jars
Accessories	—	—	Mincer, juicer	Mincer attachment	—
Special features	Beating speed control from 200–500 r.p.m.	For mixing liquids and semi-liquids including butter making	Detachable mixer head	Unbreakable bowls	Easily replaceable jars
Finish	White enamel with black fittings and base	Polished aluminium	Cream or white	Cream enamel, black plastic handle and speed control	White
Price (excl. P.T.)	£15 12 0	£1 5 0	£14 11 0	£18 0 0	£9 3 4
Price of accessories (excl. P.T.)	—	—	Mincer: £4 17 6 Juicer: £1 19 0	On application	—
Purchase tax	£5 12 7	£1 12 0	£5 6 5	£6 15 0	£3 8 9
P.T. on accessories	—	—	Mincer: £0 17 10 Juicer: £0 7 2	—	—

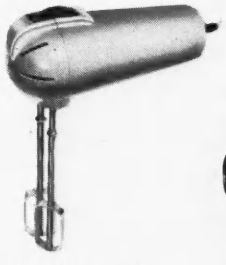
Manufacturer	Kenwood			L.P. Patents		
Name or model	"Chef"	"Minor"	"Kenmix"	"Junior"	"Senior"	"Twin"
Capacity	6 pint	—	2 pint	1 litre	1 litre	3 litre
Standard equipment	Glass bowl, beater, whisk, dough hook, etc.	Two beater paddles	—	Liquidizer goblet	Liquidizer goblet	Bowl, dough hook and whisks
Accessories	Mincer, liquidizer goblet, colander and sieve, shredder and slicer, potato peeler, coffee mill, juice separator, can opener, etc.	—	—	—	—	Liquidizer goblet
Special features	Four power outlets, "Planetary Action" mixing	Portability, hangs on wall when not in use	Liquidizes, grinds	2 speed motor	4 speed motor	4 speed motor
Finish	White enamel	White and black plastic	Chromium with black relief	Cream enamel	Chromium	Cream enamel
Price (excl. P.T.)	£19 10 6	£7 5 0	£12 12 0	£12 15 6	£15 2 6	£21 5 9
Price of accessories (excl. P.T.)	On application	—	—	—	—	£2 15 0
Purchase tax	£7 2 9	£2 13 0	£4 12 2	£4 12 3	£5 9 3	£7 13 8
P.T. on accessories	—	—	—	—	—	£0 9 11



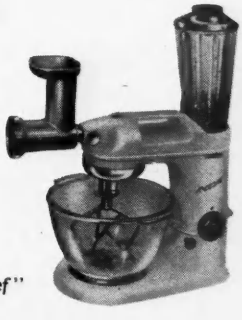
Brown Bros. "Duco"



Kenwood "Minor"



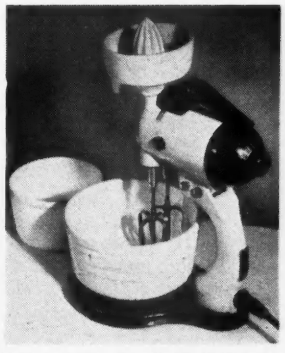
Valmade "Valmix"



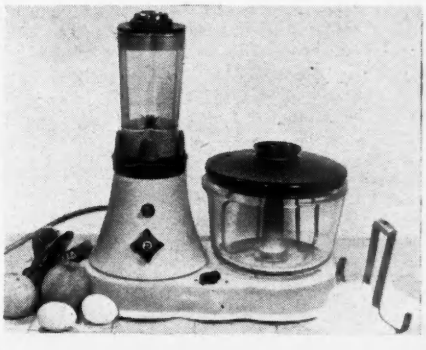
Right: Kenwood "Chef"

Below: L.P. Patents "Twin"

Howard Foss 2 pint food mixer



Midland Repetition "Rapide Mixstir"



MIXERS . . . . . *continued*

Manufacturer	Midland Repetition	Siroma	Valmade
Name or model	" Rapide Mixstir "	FM4A	" Valmix "
Capacity	5 pint	5 pint	—
Standard equipment	3 and 5 pint bowls, juice extractor	2 heat resisting glass bowls	—
Accessories	—	Juicer, mincer, power gear unit	Stand
Special features	8 speeds, automatically controlled	—	Portability
Finish	White and black stove enamel	Black and white stove enamel	Cream plastic
Price (excl. P.T.)	£18 7 6	£14 10 0	£5 5 6
Price of accessories (excl. P.T.)	—	Juicer: £1 10 0. Mincer: £2 5 0. Power gear unit: £4 0 0	£0 12 6
Purchase tax	£6 14 4	£5 6 0	£1 19 6
P.T. on accessories	—	Juicer: £0 5 6. Mincer: £0 8 3. Power gear unit: £0 14 7	—

LIST OF MANUFACTURERS

A.B. Metal Products, Ltd., Ynysboeth, Abercynon, Glam.
Brown Bros., Ltd., Great Eastern Street, London, E.C.2.
Bulpitt & Sons, Ltd., Icknield Street, Birmingham, 18.
Churn Co., Station Road, Hailsham, Sussex.
Dualit, Ltd., Picton Street, Camberwell, London, S.E.5.
Easipower, Ltd., 213–215, Gloucester Place, London, N.W.1.
English Electric Co., Ltd., Queens House, Kingsway, London, W.C.2.
Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1.
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
H.M.V. Household Appliances, Hayes, Middx.
L. G. Hawkins & Co., Ltd., 30–35, Drury Lane, London, W.C.2.
Homefyre, Ltd., 66–72, Brewery Road, London, N.7.
Hotpoint Electric Appliance Co., Ltd., Peterborough.
Howard Foss, Ltd., Belvidere Works, Totton, Hants.
Kenwood Electrics, Ltd., 26, North Audley Street, London, W.1.
L.P. Patents, Ltd., Paladin House, Bassett Avenue, Southampton.
Midland Repetition & Auto Mfg. Co., Ltd., Bayton Road, Exhall, Coventry.
Morphy-Richards, Ltd., 121, Victoria Street, London, S.W.1.
Ormond Eng. Co., Ltd., Ormond House, Rosebery Avenue, London, E.C.1.
Premier Electric Heaters, Ltd., Keeley Street, Birmingham, 9.
T. Price & Son (Stampers), Ltd., Spring Hill Passage, Birmingham.
Siroma Engg. Co., Ltd., North Acton Road, London, N.W.10.
Telsen Electric Co. (1935), Ltd., Fitzgeorge Street, Collyhurst, Manchester, 9.
Valmade, Ltd., New Chapel Road, Feltham.
Vidor, Ltd., West Street, Erith, Kent.

Brazilian Trade Prospects

THE Brazilian market for consumer goods in the past has been considerable, but the combination of exchange shortages and the desire to encourage national industries by the exclusion of foreign products has rapidly changed the character of Brazil's imports over the past few years. When exchange difficulties ease, the market for high quality consumer goods may improve, but it is unlikely that there will ever again be a large market for ordinary imported consumer items.

In his report on the economic and commercial conditions in Brazil (H.M. Stationery Office, 5s net), Mr. W. Godfrey, O.B.E., Minister (Commercial) at H.M. Embassy, Rio de Janeiro, deals at some length with the development of Brazilian industry, and particularly with the electrical industry. The accompanying table shows the wide range of electrical equipment produced in 1950. The value of the industry's output in 1951 was estimated at cruzeiros 3,200 million (£64 million).

In April, 1952, the Brazilian Government established the Executive Commission for the Electrical Goods Industry to carry out studies for the development of that industry, including heavy electrical plant. The first result of the Commission's activities was a Decree in January, 1953, providing for measures to encourage the installation of the turbine and heavy electrical equipment industries. As the manufacture of different lines is begun or expanded, the importation of similar products is to be restricted or prohibited, according to the supply position and technical and price factors.

Imports are now largely of machinery and plant and of raw materials required for the development of Brazilian industry. Imports from the United Kingdom, although a long way behind those from the United States, are still considerable, but for the reasons already given it seems improbable that they will be on the scale of those for 1951 and 1952, and the prospect is one of an inevitably harder struggle for a reduced volume of trade. United Kingdom exporters should be able to obtain some of the business resulting from Brazil's programme for development, to the extent that this is financed by loans from the International Bank for Reconstruction and Development which are not tied to any source of supply of equipment.

The United Kingdom has lost valuable ground by the long delivery periods quoted, delays in delivery and by unwillingness, or inability, to quote firm prices at the time of tendering. Competition from Germany, Japan, France and Italy is also increasing. Adequate representation, particularly in the Rio de Janeiro and Sao Paulo areas, is essential. In appendices to his report, Mr. Godfrey sets out in some detail the electrical imports of Brazil for the years 1951 to 1953, showing the principal sources of supply.

Considerable expansion is taking place in the electricity supply industry. In 1949 the installed capacity, hydro-electric and thermal, was 1,735 MW; this had expanded by 1952 to 2,297 MW and was expected to rise in 1953 to 2,545 MW. Mr. Godfrey outlines some of the more important schemes of development in hand.

Articles	*Quantities (Units) Produced*
Generators—d.c. 100 kW 440 V and a.c. to 200 kVA 2,200 V	8,000
Single-phase and three-phase transformers up to 2,500 kVA and 44 kV	6,500
Ceramic insulators for up to 69 kV	73,000,000
Starting, control, and protective switches for motors	22,500
Switchboards, etc.	5,200
Meters and other measuring instruments	115,000
Lifts	721
Electric motors, single-phase f.h.p., and three-phase, up to 75 h.p.	130,000
Telephones, automatic, and other	35,000
Telephone switchboards and components	—
Accumulators of all types	400,000
Radio receiving apparatus, etc.	300,000
Small domestic heating apparatus (irons, etc.)	450,080
Battery charging rectifiers, etc.	4,000
Ventilating fans	22,000
Floor polishers	52,000
Electric ovens	1,500
Freezing units	64,000
Reactors for fluorescent lighting	350,000
Fittings for illumination	800,000
Incandescent and fluorescent tubes	32,000,000
Welding electrodes	3,500 tons
Insulating varnishes and soldering fluxes	200 tons

THE TRANSPORT ACT, 1953

Points for Users to Watch

By GRAHAM SAVILLE

WHEN the Transport Act, 1953, became law, most electrical concerns realized that it would have a fairly widespread influence on transport, but many of them did not appreciate its practical effect on their own transport arrangements. When renewing road fund licences, they became aware that they were now having to face increased costs in the form of the new transport levy. The levy applied to most of their vehicles, as it covers practically all vehicles of over 30 cwt unladen weight. Broadly speaking, the levy is at the rate of 13s 6d for each ½ ton unladen weight. Whilst at first it may be thought that this is not a very large amount, it has had the effect of emphasizing the importance of watching the unladen weight of vehicles, and, where possible by minor adjustments, of bringing a vehicle into a lower taxation class.

Again, many firms, in order to maintain efficient deliveries, have had to rely almost solely on their own vehicles and new factors make it imperative that a review of transport arrangements should be undertaken. The increased costs, including the transport levy, are one of the factors which have to be taken into account.

Disposal of Road Haulage Undertaking

A further factor of considerable importance is the new position which is about to arise with regard to road transport. One of the major principles of the Transport Act was that the Road Haulage Executive undertaking should be sold, or disposed of. At the time it seemed that the change would be a major operation, and a long period would have to elapse before any real changes would take place.

Four methods were laid down in the Act by which the road undertaking was to be disposed of, and the principal of these methods was by the sale of transport units. These were, in the main, to be small units. It was laid down that, unless the Minister of Transport gave his approval, the units were not to comprise more than 50 vehicles, or vehicles aggregating more than 200 tons. Some units would include property, and others would not. These restrictions may mean that a number of " small men " will enter, or re-enter, the road haulage industry almost immediately.

Another feature of the Act was that the units were to be such as to permit purchasers of transport units to engage in the road haulage industry without delay. In addition, purchasers of transport units were to be granted special " A " licences which would enable them to operate their vehicles without regard to the 25 mile restriction. These points are again emphasized as they will mean that, in a matter of months, a new competitive position will arise.

Electrical firms should review their transport arrangements in order to make certain that they are obtaining their transport at the lowest possible cost coupled with an efficient service. This may mean that the time is ending when most firms have felt it essential to operate their own vehicles, and they may now be able to rely more fully on public transport.

The Act gave the British Transport Commission permission to operate fleets somewhat on the lines of those controlled by the railways before nationalization. The Commission has now issued a statement indicating the nature of the facilities it is proposing to retain, subject to the consent of the Minister of Transport.

The retained fleet is to be divided into three main sections:—General haulage vehicles primarily engaged on trunk and regular services; special vehicles engaged in furniture removal, the carriage of liquids in bulk tanks, and the carriage of abnormal indivisible loads which will be operated in the name of " Pickfords "; and vehicles provided under period contract for the exclusive use of traders. This will mean that the network built up by the British Transport Commission for the carriage of parcels will have to be disposed of. Discussions are, apparently, being held to ascertain whether it is possible to transfer this network to a company; provision for the creation of such companies is made in the Act.

Of the " trunk " vehicles, some 2,300 will be retained out of 20,000. About two-fifths of the 2,000 vehicles engaged in furniture removal and other activities mentioned will also be disposed of, and only a small proportion of the 3,000 vehicles operated on contract will be retained. Thus, although a very large number of vehicles will be disposed of by the Commission, the size of its remaining fleet will still be considerable. In addition, it may not be possible for the Road Haulage Disposal Board to obtain satisfactory tenders for the vehicles and units that it is desired to sell.

Railway Competition

Coupled with this change in road transport, a more competitive spirit appears to be arising with regard to railways. There are already indications that the railways are prepared to quote more competitive rates and are taking steps to reduce their costs. They are contemplating extensive changes in their accounting arrangements; these are already in operation to some extent. Electrical firms will have to watch that these changes do not affect them adversely.

The new Transport Act does not remove the obligation placed on the British Transport Commission to prepare draft schemes of charges. These schemes will provide only for maximum charges, and not for schedules of charges as previously. This will mean that the railways will be in a position to quote more competitive figures, and at the present time it is essential that firms shall scrutinize the rates they are paying in order to make certain that these represent the greatest concessions possible. The obligations placed on the railways to publish their rates and to avoid undue preference have been discontinued.

In considering rates, it should also be understood that under the Act the licensing authorities, when considering applications for carriers' licences, have been instructed to pay regard to the cost of transport. The ultimate interpretation of this new ruling is not yet clear, but transport users should have it in mind when they are involved in any question of road rates.

In conclusion, it should be stressed that the points mentioned represent some of the new features which are coming into being in the transport field, and electrical firms should watch for further developments, both from the Transport Act and from other legislation which is likely to take form in the next few months.

Valve Reliability

Causes of Failure Discussed by I.E.E. Radio Section

OPENING the discussion of the paper on valve reliability which Dr. E. A. O'Donnell Roberts presented before the Radio Section of the Institution of Electrical Engineers last week (see *Electrical Review*, 12th March, page 484), Dr. G. H. Metson (Post Office) remarked that mechanically reliable valves were now in sight. The next stage was to increase their life, which he believed could be doubled by removing silicon contaminant in the core, and by the control of the residual gas levels.

Mr. E. G. Rowe (Standard Telephones & Cables) suggested that valve makers should convince circuit designers that reliability depended upon the way in which the valves were used. Only by co-operation between valve makers, circuit designers and users could circuit reliability be achieved.

Mr. C. W. Howes (M. o. S.) was chiefly concerned with the first 100 or so hours of airborne use under conditions of vibration and shock. The author had indicated the possibility of reducing to a very low rate catastrophic failures in aircraft for the few hours of any one flight, but there were also early random failures, both mechanical and electrical, which appeared to be due to minor faults in processing and in manufacturing techniques.

Low failure rates entailed testing very large numbers of valves and not relying on flight testing, which would take far too long. Manufacturers should preferably be equipped to do large scale testing under conditions simulating the more severe ones encountered in service use. Constant attention would have to be paid to inspection and processing, and sampling on a much larger scale than in the past.

Special Quality Valves

Mr. R. Brewer (G.E.C.) referred to failures caused by what the author referred to as "insufficient appreciation during design and manufacture of the requirements," and suggested that that meant, in effect, that valves had been misused or overrun. The first step, therefore, was to produce a valve which was suitable for the job which it was intended to do, for which the figures given by the author for the flight trials in comparison with standard valves were impressive.

The author had extrapolated the expected life in service of special quality valves, and that might be looked at differently. The special quality valve was in effect nothing more than a valve which was no longer being misused, and to that extent tests on ordinary valves which similarly were not being misused might forecast the failure pattern with special quality valves.

Mr. J. Speirs (R.A.E.) said that the R.A.E. had been concerned both with laboratory testing and with service trials of special quality valves. No system of testing had any relationship to actual field trials, as in the case of noise and microphony. It was very difficult to produce any test which would reliably correspond with that obtained in the equipment. Field trials showed that sudden or catastrophic failures were diminishing in number as knowledge of the physics underlying the use of glass, mica and metal improved.

Mr. Wyke, who had examined many thousands of valves returned from flight trials, found that probably 40 per cent were, according to the specification, perfectly sound, but when tried in equipment they proved to be faulty. Far too many equipments worked with valves on one spread of the limits, and until early sets were thoroughly volt-tested and a full spread of valves taken, there would still be trouble with catastrophic failure due to non-mechanical breakdown.

Mr. G. D. Redston, speaking as a glass technologist and referring to compressive stress in the outer surface of the base to prevent base cracking, said he found it hard to believe that small cracks in the nickel pin were kept from extending by a small compressive surface stress put into the base, because the nickel pin jutted into the glass far too much, so that the surface stress layer was not at the end of the nickel pin. Moreover, he knew of satisfactory valves with no strain setting at all.

Air Marshal Sir Owen Jones said that his department recorded the results with valves in use in as many aircraft as possible of the same type and doing the same job. These results showed that in different positions the same type of valve had different failure rates, indicating that the designer of the circuit had been cramped by one of several factors, including not having the exact valve he wanted and having to design for heat dissipation.

Mr. J. H. Phillips referred to the possibility of devising some test which would quickly reject the substandard valve, leaving the good one untouched. Perhaps in the future there would be some means of filtering out incipient failures before the valves were acquired.

Mr. C. C. Vodden submitted that there might have been some tendency towards over-simplification in the case of fatigue failures at high temperatures. Heaters could become embrittled during running to an amount depending on the running temperature.

Brigadier E. J. H. Moppett commented on a tendency to overlook the fact that tungsten was a sintered powder having considerable physical variations between specimens. In an American factory he had seen samples of tungsten from every reel examined under an electron microscope against a set fracture pattern.

Mr. Palethorpe, Mr. Ross and Mr. F. M. Foley also contributed to the discussion to which the author made a brief reply.

Iron and Steel Institute

THE Council of the Iron and Steel Institute has accepted an invitation from the Council of Jernkontoret, Stockholm, to hold a special meeting of the Institute in Sweden from Monday, 7th June, to Friday, 18th June. Mr. G. Frisell, who was formerly managing director of Jernkontoret, has undertaken responsibility for the arrangements in Sweden. Travel arrangements between the United Kingdom and Sweden, and hotel accommodation are being arranged on behalf of the Institute by Thos. Cook & Son, Ltd.

The meeting will be divided into three sections as follows: Section I, from 7th to 10th June, in Gothenburgh and Vasteras; section II, from 10th to 13th June, in Stockholm; and section III, from 13th to 17th or 18th June, including three alternative excursions by special sleeping car trains to the steel-making or iron mining areas. Full particulars of the meeting are available from the Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W.1.

GENERATION AND DEVELOPMENT

Further Rise in Output

LAST month's increase in electricity generated by the British Electricity Authority and the North of Scotland Hydro-Electric Board, 13·9 per cent, was the highest for nearly three years.

ELECTRICITY GENERATED AND PLANT INSTALLED*

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total†		
British Electricity Authority ...	3,555	103	15·2	6,424	45	6,478	6,100	18,602
N. of Scotland H.E.B.	28	1	1·1	41	85	131	129	567
Total for February, 1954 ...	3,583	104	16·3	6,465	130	6,609	6,229	19,169
Corres. total for February, 1953	3,166	87	7·9	5,677	110	5,802	5,472	17,797
Increase or decrease, per cent ...	+13·2	+19·5	+106·3	+13·9	+18·2	+13·9	+13·8	+7·7
Total to date (2 months), 1954...	7,421	210	34·4	13,410	292	13,731	12,942	
Total for corres. 2 months of 1953	6,865	183	19·4	12,158	221	12,411	11,705	
Increase or decrease, per cent ...	+8·1	+14·8	+77·3	+10·3	+32·1	+10·6	+10·6	

* Comprising all generating stations controlled by the British Electricity Authority and the North of Scotland Hydro-Electric Board.

† The total figure includes 9·9 million kWh generated by oil engines and 4·2 million by waste heat plants in February, 1954.

As shown in the above table, the total quantity of electricity generated was 6,609 million kWh compared with 5,802 million a year ago. Generating plant capacity was again unchanged at 19,169 MW, the same figure as at the end of 1953.

Quasi-Domestic Premises

At the Southern Electricity Consultative Council's meeting at Reading on 9th March, under the chairmanship of Group Captain J. C. M. Hay, O.B.E., it was reported that when the financial results of the working of the commercial tariffs were known and when further information had been obtained from the Council the Board would give consideration to the reclassification of quasi-domestic premises for tariff purposes.

Commercial Catering

The South West Scotland Electricity Board has decided to introduce, with immediate effect, a commercial catering tariff which will apply to supplies of electricity used for the preparation and service of meals in hospitals, restaurants, hotels, clubs, cafes, canteens, school kitchens and similar premises. It will not, however, apply to supplies for lighting or heating these premises. The charge will be a flat rate of 1d/kWh plus a variation based on the price of coal.

Revised Commercial Tariff

In last week's issue we published details of the South East Scotland Electricity Board's new standard industrial tariffs which incorporate variations made necessary by the new bulk supply charges. The Board has now announced a revision of its commercial demand and unit tariff, with effect from 1st April, to allow for these changes. The fixed charge is to be £7 10s per kW of maximum demand in each year of account and the running charge 0·85d/kWh, subject to adjustment at the rate of 0·00075d/kWh for each 1d variation in the cost of fuel from the basic figure of 60s a ton.

Fuel Efficiency in Cotton Mills

The Federation of Master Cotton Spinners' Associations, Manchester, representing owners of 450 mills, has appointed a special technical committee to examine methods of increasing the cotton spinning industry's general efficiency in the use of electricity and coal.

School Lighting

In its eighth and final programme of work on the installation of electricity in gas-lit schools the L.C.C. Education Committee proposes to include the following county primary schools:—Falconbrook (Battersea North), Hitherfield (Wandsworth–Streatham), Royal Hill (Greenwich) and Peckham Park and Watling (Camberwell–Peckham). The Further Education Sub-Committee has agreed to the inclusion in the programme of Battersea Men's Institute (Battersea South). The estimated total expenditure is £19,500, of which £19,225 is likely to be incurred in the financial year 1954–55.

House Wiring Plans

Work is to commence soon on the construction of a substation as a preliminary to supplying electricity to houses in the Benwell area, Newcastle-on-Tyne, at present served only by gas. About 2,600 houses are involved. Proposals for supplying the houses were put forward years ago, but the work was delayed owing to restrictions on capital expenditure.

Stanley (Co. Durham) U.D.C. has been informed that the North Eastern Electricity Board is to reinforce the network at Craghead. The Council has decided to install electricity in 67 houses and 49 bungalows in the area and it is possible that another 94 houses already wired for electricity will be fitted with further points.

Financing Irish Expansion

Expenditure of £100 million for an extensive electrical development programme prepared by the Irish Electricity Supply Board, at the request of the Minister for Industry and Commerce, is provided for in the Electricity Bill published last week in Dublin. Of this sum, statutory provision has already been made for £72,975,066. The programme is designed to provide additional generating capacity which, it is estimated, will increase output from 1,300 million kWh in the year ending 31st March next to 3,350 million kWh in 1960–61. The programme is based on the maximum possible utilization of native water and peat resources. A further sum of £38 million will be required to complete the programme. So far the finances of the Board have in the main come from the Exchequer. The Bill gives power to the Board to borrow on its own responsibility in future.

Assisted Wiring

Penrith U.D.C., which circularized 262 tenants to ascertain whether they wanted electricity installed in their houses, has received 177 replies. Of these 169 were in favour of a supply, but 155 wished the service to be given under an assisted wiring scheme. The Council has agreed to advance up to £25 for a three-bedroomed and £22 10s for a two-bedroomed house, the amounts to be repaid with 3 per cent interest in five years.

Electricity Supply Handbook

The 7th edition of the *Electrical Times* "Electricity Supply Handbook," while retaining the same general structure, now includes an alphabetical list of power stations. Principal details of plant are given for installations over 10 MW. A slight alteration has been made to the thumb indexing and the early closing days of service centres have now been listed. The Handbook, with a cloth bound spine, is available at 5s from the *Electrical Times*, Sardinia House, Sardinia Street, London, W.C.2.

Siberian Hydro-Electric Scheme

Work has recently begun on the first of a series of power stations on the Angara River in Siberia, the output of which will be used to develop the metallurgical, chemical and other industries in the region. It is claimed that the potential water power reserves of the Angara River are greater than

those of the Volga, Kama, Dnieper and Don combined. Rising in Lake Baikal, the Angara is remarkable for its steady flow throughout the year; 330 large and small rivers flow into the lake, but only the Angara flows out. Abundance of water and the regulating influence of the lake make it possible to construct a number of hydro-electric power stations with very low capital investment per kilowatt. The first (Irkutsk) station will have more than double the water capacity of the Dnieper hydro-electric station.

Record Canadian Output

The Dominion Bureau of Statistics reports that Canada's electricity production rose by about 6 per cent to a record high level of 65,489 million kWh in 1953 (against 61,786 million in 1952). The year's consumption of primary power—production, less exports and secondary power—advanced by a little more than 7 per cent to 59,690 million kWh from 55,568 million in the previous year. Gross exports to the United States dropped slightly to 2,424 million kWh from 2,493 million. Output during the year in the various provinces was as follows, with 1952 figures in parentheses (million kWh):—Quebec, 33,950 (32,142); Ontario, 19,025 (18,167); British Columbia, 5,226 (4,667); Newfoundland, 213 (171); Prince Edward Island, 31 (28); Nova Scotia, 1,039 (955); New Brunswick, 747 (741); Manitoba, 2,791 (2,696); Saskatchewan, 1,168 (1,074); and Alberta, 1,298 (1,146).

Fluorescent Lighting in London

SINCE it was opened in 1847, New Oxford Street, in the West Central district of London, has been lighted by gas, but this has now been displaced by fluorescent lighting installed by the General Electric Co., Ltd., for the Holborn Borough Council. The scheme covers not only New Oxford Street and St. Giles Circus but also part of Kingsway, Shaftesbury Avenue, Southampton Row, Charing Cross Road and Tottenham Court Road.

In all there are 108 G.E.C. "Four Eighty" type lanterns—wired for instant start. Each houses four "Osram" 5ft 80 W daylight fluorescent lamps. The mounting height is 25ft; 86 of the lanterns are on single-arm columns and 22 on double-arm columns; spacing between columns averages 100ft. The lanterns have a high light output and each has been fitted with a time switch which cuts out two tubes at 1 a.m. when traffic is at the minimum. Even with this cut a uniform appearance is maintained throughout the installation.

In addition to the main installation the G.E.C. also supplied and erected seven central island tubular steel columns each carrying a 12in diameter opal globe housing one 200 W tungsten lamp.

Some of the columns used for gas lighting were adapted for the new system. Others were removed and re-erected where additional columns were needed. Many columns, span wires and gear were dismantled. All this work was done by the company's mobile erection squad. Erection began on 4th January and was completed on 1st March. The work was done with the co-operation of the London Electricity Board and the North Thames Gas Board. Throughout, the G.E.C. staff worked closely with Mr. K. C. Iliffe, LL.B., A.M.I.C.E., engineer and surveyor to the Holborn Borough Council, and his assistants, Messrs. W. Dainton and J. A. T. Reeder, the public lighting superintendent.

A formal switching-on ceremony was performed by the Mayor of Holborn (Councillor J. C. St. L. Stallwood) on 9th March.

Fluorescent lighting in New Oxford Street, London

STREET LIGHTING PLANS

BOURNEMOUTH Highways and Works Committee recommends that, subject to loan sanction, tenders should be invited for the improvement of main road and by-road lighting at an estimated cost of £23,850.

BERMONDSEY Finance Committee has received consent to borrow £16,306 for improved lighting in Tower Bridge Road, etc.

DONCASTER Watch Committee has recommended the carrying out of lighting schemes in Thorne Road, Balby Road, etc., at a cost of £7,500.

APPLEBY Town Council has approved a scheme for converting the town's street lighting, with the exception of the Scattergate area, from gas to electricity.

MORLEY Corporation is recommended to authorize the preparation of schemes for the installation of 140 W sodium discharge lamps in three road sections.

RUGBY Corporation is recommended to seek sanction to borrow £3,900 for lighting on the Abbots Farm housing estate.

EARLS BARTON (Northants) Parish Council is to proceed with the conversion of street lighting from gas to electricity and provision of electric lamps for new estates.

During the next twelve months HINCKLEY (Leics) Urban District Council plans to provide 162 new street lamps at the estimated cost of £3,286.

HARWORTH AND BIRCOTES (Yorks) Parish Council is to proceed with the reorganization of the street lighting at the estimated cost of £3,200.

PRESTON-ON-TEES Parish Council is considering installing electric street lighting on part of the trunk road through Eaglescliffe.

GOSFORTH (Northumberland) U.D.C. is seeking loan sanction for £6,102 for proposed street lighting developments.

At a cost of between £1,700 and £1,800 HALIFAX Highways Department is to install sodium lighting on the Leeds Road from Stump Cross to the borough boundary.

RAWTENSTALL Highways and Sewering Committee has considered an estimate of £14,530 submitted by the borough surveyor, for lighting the whole of the A56 trunk road within the borough. Plans of the installation are now being prepared.

RAYLEIGH (Essex) U.D.C. proposes to improve the lighting of London Road, Crown Hill and High Street at a cost of £4,860.

NEWCASTLE-ON-TYNE City Council has received loan sanction at £4,952 for the provision of street lamps on housing estates outside the city area.

SCARBOROUGH Town Council is recommended to spend £10,000 on street lighting improvements this year.

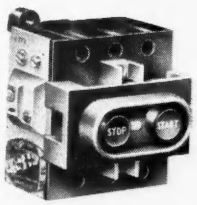
NEW ELECTRICAL EQUIPMENT

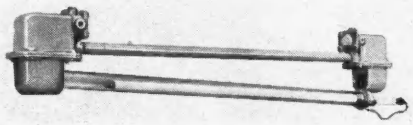
F.H.P. Motor Starters

WHEN f.h.p. motors are installed on small machines it is unusual to provide facilities for remote control or protection against under-voltage. Except where special conditions exist, the demand is for a small control unit without no-volt release. The I.E.E. Wiring Regulations permit the use of this type of starter for controlling motors up to ½ h.p. The type D6 hand-operated starter offered by J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall, Staffs, has been designed to satisfy not only this specialized need but also provide a number of new features and a standard of performance comparable with that of heavier contactor type control gear.

The small size of the D6 starter has been achieved by recessing the triple-pole switch into the front and the overload relays into the back of a rectangular moulding. Each heating element as well as all parts of different polarity are thus effectively separated within a space of 3in by 3in by 1 in, the bearing for the switch mechanism, the overload setting lever and the earthing connection being secured to a strong steel side plate.

The unit incorporates adjustable thermal overload releases with ambient temperature compensation and is suitable for operation on single- or three-phase a.c. supplies up to 600 V. The patterns available include interiors only for inset mounting, and complete units in steel cases for either flush or surface fixing.





Left: Interior of Crabtree D6 f.h.p. motor starter. Right: G.E.C. 5ft flameproof fluorescent fitting

Flameproof Fluorescent Fitting

A 5ft flameproof fluorescent lighting fitting made by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has a high safety margin. The maximum internal pressure can reach only about a half of the safety figure allowed, while a special flameproof lampholder and other features reduce the piling pressures which are usually obtained in fittings of tubular construction. The fitting can be used for any situation covered by Groups I and II of the Flameproof Regulations. Maintenance of the fitting is simple. Re-lamping can be done with one hand from one end by slackening off a single captive bolt, twisting and sliding the glass tube which encloses the fluorescent tube and lowering to the re-lamping position. The fittings can be installed in a continuous row, end to end, and pairs of adjacent fittings maintained from one ladder position.

All auxiliary gear is fitted in the aluminium alloy end castings and wired complete. The terminal chamber in one end casting is tapped 1in e.t. for either top or side through entries, two blanking off plugs being supplied. All external aluminium parts are finished with a pre-treatment primer and stove enamelled. Stove-enamelled steel reflectors are available if required. Conduit fixing centres are 4ft 6¼in apart.

Industrial Refrigerators

Two new "Prestcold" refrigerators are announced by the PRESSED STEEL CO., LTD., Cowley, Oxford. The SC175 is a 17·1 cu ft model, and it has a shelf area, including the cabinet bottom, of 26·2 sq ft; it is provided with a salad "crispator" and a removable chill tray. It is operated by a "Presmetic" a.c. power unit which has the compressor, motor and all moving parts hermetically sealed in a welded steel case. This unit is guaranteed for five years. The one-piece internal lining is of heavy gauge steel with rounded corners and finished in white vitreous enamel, and the exterior is in white synthetic enamel. The flush-fitting doors are finished to match the cabinet and slam-type latches and chromium plated strain-proof locking handles are fitted.

The overall dimensions are 66⅜in high by 44½in wide by 28½in deep. The refrigerant is non-toxic, odourless, Arcton "6" (Freon 12) and each model is thermostatically controlled.

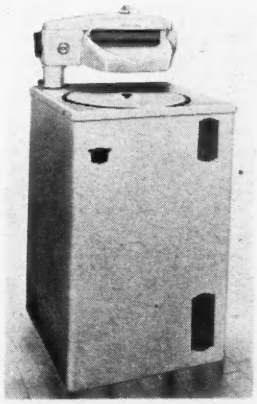
The SC176 is similar in shape and size except that in place of the salad "crispator" and chill tray two removable meat rails supported on four ceiling hangers are provided. This particular cabinet is designed for the small butcher or grocery trade. The respective prices are £160 (SC175) and £144 (SC176).

"Prestcold" SC175 service cabinet

Heated Washing Machine

The 54H cabinet type washing machine introduced by THOR APPLIANCES, LTD., 64–66, Oxford Street, London, W.1, has a capacity of 8 lb of dry clothes and is fitted with a full-sized Acme power wringer, pump and a 2 kW heater. The conventional type of agitator is driven by a ¾ h.p. motor fitted with a safety control.

The cabinet measures 23in square by 35in high (47in with wringer). The body and lid are finished in white stove enamel, the top in vitreous enamel. Speckled vitreous enamel is used for the tub. The price is £55 2s 6d (plus £20 13s 5d purchase tax in this country). A rotary ironing attachment can be supplied for £21 (plus £8 3s 10d purchase tax) and a vitreous enamel table top is also available as an extra. The machine is fully guaranteed for one year with a special two-year guarantee on the mechanism unit.



Thor 54H heated washing machine

Financial Section

STOCKS and SHARES

RISES of about 10s per cent over the past week, in three of the British Electricity stocks, reflect a general revival of prices in the gilt-edged market. Talk of a further reduction in Bank Rate seems to have been taken a little more seriously than before, and it was regarded as significant that the latest issue of trustee stocks bears interest at $3\frac{3}{4}$ per cent, whereas 4 per cent had been the usual rate for some time previously. Meanwhile, the industrial market has been content for the most part to keep its end up, although showing a readier disposition to respond to encouragement.

Ericsson Bonus

The announcement of an increased final dividend by Ericsson Telephones, together with proposals for a 100 per cent share bonus, duly confirm the expectations which have been buoying up persistently the price of the company's 5s ordinary shares. For some years an unusually high proportion of earnings has been going back into the business, the result being apparent in the growth of reserves to a total more than five times the size of the nominal ordinary capital of £500,000. Although there has been no great change in the profits for 1953, as compared with those of the previous twelvemonth, the austerity of the dividend policy is now being relaxed to the extent of raising the distribution for the year from 22 to 25 per cent, tax free, of which 5 per cent is declared as bonus. This still leaves nearly £330,000, out of a net surplus of £460,000, to be added to the reserves, which will retain large proportions after the share distribution. The strength of the position is reflected in the still moderate yield of about $4\frac{3}{4}$ per cent gross on the shares at their present price of 49s, a rise of 1s 6d upon the week.

Decca Changes

Changes in the quotations for Decca Record shares took place following the approval, at last week's meetings, of the capital rearrangements. As a result of these, a former holding of, say, 100 ordinary shares of 5s denomination has become 100 shares of 4s each, plus 20 preference shares of 5s each, bearing 25 per cent interest. In addition, ordinary shareholders have the right to apply for one new share, at a price of 5s each, in respect of every thirteen held. Early market dealings were at 34s in the 4s ordinary (ex all rights), at 30s premium for the new shares, and at 18s 3d for the 25 per cent preference. The last-named advanced sharply after being started at around 15s 6d.

Sir Cyril Entwistle was able to give, at the Decca annual meeting, a very satisfactory account of the group's 1952–53 trading experience. With another year already practically completed, he was in a position also to assure stockholders of continued success

Week's Price Changes

Company or Board	Nom. Value	Middle price 15th Mar.	Week's Rise or Fall	Dividend: Previous	Dividend: Last	Yield %	1953: Highest	1953: Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	90	−½	3	3	3 6 9	90	83 11/16
Brit. Elec. 1974/77	100	89	+½	3	3	3 7 6	89	82
Brit. Elec. 1976/79	100	96	+½	3½	3½	3 13 0	94¾	88⅝
Brit. Elec. 1974/79	100	104½	+½	4½	4½	4 1 3	104	99⅛
Overseas Electric Supply								
Calcutta Elec.	£1	20/-		6†	6†	6 0 0†	21/-	18/-
East African Power	£1	22/6	+6d	7	7	6 4 6	25/-	20/9
Nigerian Elec.	£1	23/6	−1/-	10	10	8 10 3	25/-	21/6
Palestine Elec. "A"	£1	19/-		Nil	Nil	Nil	19/3	7/7
Perak Hydro-Elec.	£1	14/6		Nil	6	8 5 6	17/10	13/6
Equipment and Manufacturing								
Aberdare Cables	5/-	8/3	−3d	20	20	7 7 0*	8/9	7/4
Aerialite	1/-	12/-		88½	88½	7 7 3	11/6	8/1
Allen, W. H.	£1	53/9	+6d	15	15	5 11 6	51/-	42/10
Aron Elec. Ord.	£1	43/9		15	20	9 2 9	47/6	36/3
Assoc. Elec. Ord.	£1	45/6		20	11½*	4 19 0	45/7	36/4
Automatic Tel. & El.	£1	66/3		15	15	4 11 6	65/3	55/-
Babcock & Wilcox	£1	48/3	+3d	18	18	—	50/-	40/4
Baldwin, H. J.	2/-	4/9		20	20	8 8 6	4/1	3/-
Bakelite	10/-	23/9		12½	12½	5 5 3	24/9	16/-
British Aluminium	£1	38/6		12	12	6 4 8	43/10	35/-
B.I. Callender's	£1	41/-		9	10	4 17 7	40/10	33/3
B.I. Callender's 6% Pref. ...	£1	26/-		6	6	4 12 3	26/3	23/-
British Thermostat	5/-	20/-		30	35	—	19/-	14/-
British Vac. Cleaner	5/-	14/-		25	25	8 18 6	16/6	11/-
Brook Motors	10/-	34/6		20	20*	5 16 0	37/-	27/10
Brush Ord.	5/-	5/9		10	4	—	5/4	2/11
Bulgin, A. F.	1/-	3/4½		30	30	8 11 6	3/5	2/6
Burco	5/-	13/-		35	35	6 14 8*	12/2	8/6
Chloride El. Storage	£1	50/9	−6d	15	20	3 18 9*	44/10	32/3
Clarke Chapman	£1	75/9	−9d	17½	20	5 5 6	70/6	57/6
Cole, E. K.	5/-	24/3	+3d	25	25*	5 3 0	23/9	14/2
Cossor, A. C.	5/-	8/-		10	10	6 5 0	11/4	6/4
Crabtree	10/-	25/-	−1/3	17½	17½	6 13 4	32/6	23/9
Crompton Parkinson Ord. ...	5/-	15/9		11¼	20	6 7 0	16/-	8/7
De La Rue	5/-	13/6	+1/-	35	Nil	Nil	14/6	6/3
Decca	4/-	34/-xr		150	35*	—	37/9	17/6
Desoutter	5/-	17/9	−6d	18	20	5 12 9	17/6	14/3
Dewhurst	2/-	5/9		19	19	6 12 3	6/9	5/-
Dictograph Tel.	2/-	5/9		20	20*	6 19 3	5/10	3/10
Dubilier Condenser	1/-	4/9	−3d	28	25*	5 5 3	4/4	2/10
E.M.I.	10/-	14/6	+1/6	12	8	5 10 3	15/3	11/6
Electrical Components	5/-	11/3		20	20	8 17 10	12/-	9/3
Elec. Construction	£1	56/6	−6d	15	15	5 6 3	56/-	50/6
Enfield Cable Ord.	£1	19/-	−1/-	7½	5	5 5 3	24/10	17/-
English Electric	£1	40/-		15	10*	5 0 0	40/8	34/-
English Electric 3½% Pref. ...	£1	16/-		3½	3½	4 13 9	16/4	14/6
Ericsson Tel.	5/-	49/-	+1/6	22†	25†	2 11 0†	48/9	36/-
Ever Ready	5/-	27/6		35	35	6 7 3	29/-	25/-
Falk Stadelmann	£1	38/3		15	15	7 16 10	44/3	38/3
G.E.C. Ord.	£1	40/-		22½	11½*	5 12 6	46/-	36/3
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	27/7	24/9
General Cables	5/-	16/9		30	30	8 19 2	17/-	14/9
Greenwood & Batley	£1	43/9		15	17½	8 0 0	41/6	38/-
Hackbridge Cable	5/-	13/6	+9d	20	20	7 8 3	13/-	10/6
Hackbridge & Hewittic	5/-	18/3		20	20	5 9 6	18/3	16/1
Hall Tel. Acc.	10/-	11/-		10	10	9 1 9	12/7	8/6
Heatrae	2/-	4/-		12½	12½	6 5 0	4/3	3/3
Henley's	10/-	16/6		20	10½*	6 7 3	19/4	16/-
Holophane	5/-	14/9		20	20	6 15 7	13/9	11/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

since then. Among the interesting matters to which he referred were the increase in the group's turnover since the war, from one million to well over seven millions; the retention of 60 per cent of the last year's profits in the business; the large excess profits levy charge; and the board's intention of distributing next time on the ordinary shares, in their new form, a sum at least as great as that just paid. The last point indicates a prospective dividend of not less than 1s 9d per share, or about 44 per cent.

...in Electrical Investments

Company or Board	Nom. Value	Middle price 15th Mar.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1953 High-est	1953 Low-est
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	32/9	−6d	25	45	6 17 6	26/10	20/3
I.C.I.	£1	56/6	+3d	13	15	5 6 3	54/-	41/6
Intl. Combustion	5/-	18/6	+1/-	15	20	5 8 0	15/6	12/1
Johnson & Phillips	£1	50/-		15	15	6 0 0	59/3	49/-
Lancashire Dynamo	£1	44/6	−6d	12½	12½	5 12 3	47/-	41/-
Laurence, Scott	5/-	16/3		15	15	4 12 4	14/6	11/9
Lister, R. A.	£1	35/-		9	12	6 17 2	34/3	27/9
London Elec. Wire	£1	39/-	−1/-	12½	15	3 17 0*	38/3	26/-
Lucas, J.	£1	58/6		9⅛	10⅝	3 14 0	51/3	35/6
Marryat & Scott	2/-	6/6	+1/3	22½	22½	6 18 6	6/3	5/1
Mather & Platt	£1	55/6		12½	15	5 8 0	53/10	41/3
Metal Industries	£1	31/6		15	12*	7 10 0	47/9	37/9
Midland Elec. Mfg.	£1	65/-	+1/3	15	15	4 12 3	63/9	56/3
Morphy-Richards	4/-	22/-		40	40	7 5 6	16/3	13/-
Murex	£1	51/-		15	15	5 17 8	60/9	50/6
Newman Ind.	2/-	2/4½		10	10	8 8 6	2/10	2/-
Oldham & Son	1/-	2/9		35	17½*	6 7 3	2/10	2/2
Parnall (Yate)	5/-	5/3	+1½d	6	6	5 14 3	4/9	2/6
Parsons, C. A.	£1	42/6		10*	12½	—	48/-	27/9
Plessey	5/-	44/-	+1/9	25	30	3 8 3	37/-	20/1
Pye Deferred	5/-	19/-		18	20	—	16/3	10/6
Revo	10/-	17/6		27½	27½	—	17/6	13/11
Reyrolle	£1	72/6	+2/6	10*	12½	—	79/-	51/-
Rheostatic	4/-	12/-	+9d	19	20	6 13 4	12/-	8/-
Richardsons Westgarth	5/-	11/-		12	15	6 16 3	11/1	8/6
Scottish Cable	4/-	14/3	+6d	32	20*	5 12 3	13/3	11/1
Siemens Ord.	£1	38/3		10	10	5 4 7	37/-	31/6
Smith (England), S.	4/-	8/6	−3d	12½	15	—	12/6	7/11
Southern Areas	£1	17/6	−3d	5	6	6 17 3	19/7	10/3
Strand Elec.	5/-	8/9		17½	17½	10 0 0	10/-	7/9
Sturtevant	5/-	33/9		17½†	18·1†*	—	29/9	20/10
Sun Elec.	£1	25/-		15	15	12 0 0	27/-	24/6
Switchgear & Cowans	5/-	12/6		22½	22½	9 0 0	16/9	12/6
Taylor Tunnicliff	5/-	11/3		25	12½*	5 11 0	12/3	9/6
T.C.C.	10/-	44/6		20	20*	—	42/6	31/5
T.C. & M.	£1	31/-		10	8½*	5 9 9	31/6	25/6
Telephone Mfg.	5/-	8/6		10	10	5 17 8	9/4	7/1
Thorn Elec.	5/-	16/9	+3d	12½	12½	3 14 8	14/-	7/10
Thornycroft	£1	36/3		15	15	8 5 6	54/-	29/9
Tube Investments	£1	61/3	−1/3	15*	15	4 18 0	71/9	54/-
Vactric	5/-	9/6	+9d	Nil	Nil	Nil	10/3	3/6
Veritys	5/-	7/-		7½	10	7 2 9	5/4	4/1
Walsall Conduits	4/-	46/3		70	70*	6 4 6	47/6	43/9
Ward & Goldstone	5/-	45/-	+1/3	45	45*	5 0 0	46/-	29/9
Watford	2/-	5/9	+6d	25	25	—	5/6	4/10
Westinghouse Brake	£1	67/6	+1/3	14	15	4 9 0	64/-	51/3
West, Allen	5/-	14/9	−3d	15	15	5 1 9	14/4	10/3
Wolf Electric	5/-	13/6		—	15	5 11 0	12/8	9/6
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	87½	+2	—	6	6 17 3	91	77
Ord.	100	52½		—	3¾	7 2 10	57½	53
Anglo-Portuguese	£1	21/-	−1/-	8	8	7 12 6	23/9	20/1
Brit. Elec. Traction:								
Def. Ord.	5/-	43/6	+1/6	25	35	4 0 6	39/6	21/3
Cable & Wireless:								
Ord.	£1	33/6	−3d	8	9	5 7 0	148	124
4% Loan	100	96½	−1	4	4	4 3 0	97½	93
Calcutta Trams	£1	18/-	−1/-	6†	2½†	—	23/6	16/-
Cape Elec. Trams	£1	14/6		5½	5½	7 11 9	13/-	9/-
Marconi Marine	£1	28/3		10	10	7 1 7	31/6	26/9
Oriental Tel. Ord.	£1	79/6	−6d	16	16	—	75/-	59/-
Telephone Props.	£1	4¾		8	8	—	126/3	33/-
Telephone Rentals	5/-	9/6		10	10*	—	10/-	6/8

Cable and Wireless

After its first enthusiastic market reception, the Cable & Wireless (Holding) Co.'s action in splitting the stock into £1 units has continued to attract buyers. The present price of 33s 6d is equivalent to a figure of 167½ for the stock in its old form. Allowing for the subsequent 10 per cent share bonus, this represents an advance of around 20 points since the day before the change was announced. Events seem to be fulfilling well the object of the operation. This was to make the stock more easily available to the small investor who seeks security through the wide spread of investments owned by a large-scale investment trust.

Price Changes

Reyrolle's shares again came to the front of the electrical equipment market with a rise of half-a-crown. Westinghouse Brake and Midland Electric Manufacturing were both marked up by 1s 3d, and International Combustion, still under the influence of the annual results, added 1s to the previous advance. De la Rue jumped from 12s 6d to 14s 6d on "take-over" rumours, before coming back to 13s 6d after an official denial. E.M.I. put on 1s in response, it was thought, to American buying, and Plessey were prominent once more in rising 1s 9d. Marryat & Scott were put up 1s 3d to 6s 6d, and Sun Electrical have changed hands lately at 28s 6d; the official quotation stays at 25s. Enfield Cables and London Electric Wire lost 1s each, but most of the week's reverses were merely a matter of pence.

Company News

A. F. Bulgin & Co.'s declaration of a 30 per cent dividend on the £100,000 ordinary stock is the third payment in succession at that rate. With the net profit a little above the previous year's, the distribution appears to be covered nearly twice by the available surplus. At the official quotation of 3s 4½d (cum the dividend) the 1s ordinary shares show a yield of close on 9 per cent. Rheostatic 4s shares were marked up from 11s 3d to 12s, with business recorded at 12s 9d, following the declaration of the final dividend. This makes a total for the year of 20 per cent, or 1 per cent more than last time, and is payable on capital enlarged by a cash issue of shares.

I.C.I. Issue

Application lists close next Wednesday for the £30 million issue of Imperial Chemical Industries 4½ per cent unsecured loan stock, redeemable 1972–74, at 100. General expectations of a material premium on the offered price, when dealings open, have been fortified as a result of the current strength of the gilt-edged market.

REPORTS and DIVIDENDS

The Midland Electric Manufacturing Co., Ltd.—The accounts now issued confirm the preliminary figures given in our issue of 5th March. In his circulated statement, Mr. W. L. Barber (chairman) refers to his statement last year in which he mentioned the falling-off in home trade and the impact of restrictions and difficulties then being experienced in several overseas markets. This recession in demand resulted in a reduction in the overall volume of business during the year under review. Steps have been taken to reverse this trend by the introduction of certain new lines of products, and at the same time sales promotion in export markets has been intensified. Value of sales improved in the closing months of 1953, and the volume of incoming orders at the present time is substantially in excess of that at the corresponding period last year. Work is now proceeding on the reconstruction and enlarging of the designs and research laboratories.

A. H. Hunt (Capacitors), Ltd.—Competition at home and abroad has been intense states Mr. S. H. Brewell (chairman) in his review for 1953, and has affected selling prices, but to date the company has been able to counteract this situation by increased turnover and higher efficiency. The introduction of additions to the existing range of capacitors will create further expansion during 1954. A small company has been acquired in the north-west of England, specializing in the design and manufacture of electronic equipment, and is proving valuable in assisting in the designing and manufacture of up-to-date test gear. Arrangements have been concluded with the Canadian selling agents, the Canadian Marconi Co., for the operation of a joint venture which will enable A. H. Hunt (Capacitors) to increase its activities in the Canadian market. The Canadian company, Hunt Capacitors (Canada), Ltd., has factory premises in Ajax, Ontario, and production is expected to commence in the course of a few weeks.

International Combustion (Holdings), Ltd.—The main figures in the accounts for the year ended 30th September last were given in our issue of 26th February. In his circulated statement, Mr. G. R. T. Taylor (chairman), says that the output of the group continues to increase. Their associated companies abroad and at home continue to prosper. The new company in Pakistan is consolidating its position, and the operation to transfer the control of the associated Australian company to Australia has now been completed.

They are in process of registering a subsidiary company to be named International Combustion (Export), Ltd., and also a subsidiary company to be named International Combustion Products, Ltd., which will as from 1st April take over the activities of the operating company, International Combustion, Ltd., other than the design and manufacture of steam raising plant which will remain the function of that company. Such activities to be taken over consist mainly of the marketing of mechanical stokers, pulverized fuel burning equipment, grinding, screening and filtering equipment, materials handling equipment and general engineering.

Hubert Davies & Co., Ltd., of Johannesburg, report a net profit for the year ended 31st October last, after providing £121,300 for taxation, of £281,837, as compared with £304,600 for the preceding year. It is proposed to pay a final dividend of 2s on the 10s ordinary shares, making 2s 9d per share for the year (unchanged).

In his statement Mr. R. Paget (chairman) says the shareholdings in Rhodesian Cables, Ltd., and Scottish Cables (South Africa), Ltd., remain unaltered. The company also holds 20,000 shares of £1 each in Herbert Morris (S.A.) (Pty.), Ltd. Since the close of the year it has taken up shares in E.C.C. (South Africa) (Pty.), Ltd., which will shortly manufacture transformers at a factory being built in Vereeniging. This company is an off-shoot of the Electric Construction Co., Ltd., Wolverhampton, with whom Hubert Davies & Co. have been associated for many years.

Ericsson Telephones, Ltd., reports a trading profit for 1953 of £946,574, as compared with £987,782 for 1952. Taxation (including £30,000 placed to tax equalization reserve) requires £486,513, leaving a net balance of £460,061 (against £453,146). General reserve receives £300,000, and it is proposed to pay a final dividend of 15 per cent (against 12 per cent), and a bonus of 5 per cent (same), tax free, making 25 per cent for the year (22 per cent). The balance carried forward is £266,333 (against £238,978 brought in). It is proposed to make a 100 per cent scrip issue.

The Rheostatic Co., Ltd., in a preliminary statement, shows a trading profit for the year to 30th September last of £164,160, as compared with £165,600 for the preceding year, and a net profit of £51,152 (against £44,585). General reserve receives £22,500, and it is proposed to pay a final dividend of 12½ per cent on £231,000 ordinary capital, as increased by a 5-for-28 rights issue. This, with an interim dividend of 7½ per cent on the £196,000 capital, makes a total of 20 per cent for the year (against 19 per cent).

New Companies

Pakes & Co., Ltd.—Registered 1st March. Capital £1,000. Lighting consultants, manufacturers of and dealers in electrical and lighting equipment, etc. Directors: R. C. Pakes, 60, Langler Road, N.W.10, and L. G. Pakes, 128, North Circular Road, Stonebridge, N.W.10.

Electrical Products Export (International), Ltd. — Registered 25th February. Capital £2,000. Directors: R. A. A. Palagyi, D. de Jankovich and E. F. W. Besley. Regd. office: 5, New Square, Lincoln's Inn, W.C.2.

Glanvill Brown, Ltd. — Registered 27th February. Capital £100. Electrical and mechanical engineers, manufacturers of and dealers in dynamos, motors, armatures, magnetos, batteries, etc. Directors: C. G. Brown and A. G. Brown. Regd. office: 9, Cavendish Square, W.1.

Baird & Davies Co., Ltd.—Registered 6th March. Capital £3,000. To construct, maintain and deal in radio, television and electrical apparatus, etc. Directors: J. Baird and E. M. Davies. Regd. office: 1, Stanley Street, Holyhead.

Increases of Capital

Troughton & Young (Lighting), Ltd. —Increased by £10,000, in £1 ordinary shares, beyond the registered capital of £15,000.

Partridge, Wilson & Co., Ltd.—Increased by £125,000 to £150,000. The new capital consists of 329,000 5s ordinary shares and 67,750 6 per cent £1 cumulative preference shares.

Liquidations

Mayfield Electrics, Ltd.—Particulars of claims by 25th March to the liquidator, Mr. N. Osborne, 11–12, Finsbury Square, London, E.C.2.

Hockley Electric Motor & Engineering, Ltd. — Winding up voluntarily. Liquidator, Mr. L. D. Lopes, 3, Lloyd Road, Broadstairs, Kent, appointed 6th March. Particulars of claims to the liquidator by 27th March.

Bankruptcies

A. E. Dalmon and **S. J. Dalmon,** sanitary and electrical engineers, carrying on business under the style P. Dalmon & Sons, 60, Teville Road, Worthing.—Trustee, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton, released 11th February.

G. A. Phipps, residing and lately carrying on business at 51, Frampton Crescent, Fishponds, Bristol, electrician.—Trustee, Mr. G. W. Sisman, 26, Baldwin Street, Bristol, Official Receiver, released 5th March.

C. L. Philpott, 55, High Street, Walton-on-Naze, Essex, radio and electrical dealer.—Trustee, Mr. A. W. Hunter, Walter House, 418–422, Strand, London, W.C.2, released 20th February.

K. J. Ward, lately carrying on business at "Howard," Trusthorpe Road, Sutton-on-Sea, Lincs, as an electrical contractor.—Trustee, Mr. C. T. Newman, 58–61, York Terrace, Regent's Park, London, N.W.1, Official Receiver, released 1st March.

W. J. Standing, 7, Brook Street, Chester, electrician.—Receiving order made 4th March on a creditor's petition.

Count J. P. Zaluski (deceased), electronic engineer, lately of 8, Palace Gardens Mansions, Kensington, London, W.8.—First meeting 24th March at Bankruptcy Buildings, Carey Street, London, W.C.2.

G. S. Graham, Blackfriars Street, Carlisle, electrical engineer.—Last day for receiving proofs for dividend 27th March. Trustee, Mr. D. Atkinson, 14, Lowther Street, Carlisle, Official Receiver.

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 22nd March

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio Group. "Some Aspects of the Design of v.h.f. Mobile Radio Systems," by E. P. Fairbairn.

Crescent Theatre, 6 p.m. I.E.S. Birmingham Centre. "Stage Lighting from the Producer's Viewpoint," by N. Leaker and A. Taylor.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 7 p.m. I.E.E. Western Utilization Group. "Artificial Respiration," by C. E. Dew.

LEEDS.—24, Aire Street, 6 p.m. I.E.S. Leeds Centre. Annual general meeting, followed by a film on the manufacture of glass.

LEICESTER.—E.M.E.B. Charles Street, 7.30 p.m. I.E.S. Leicester Centre. "Glass in the Lighting Industry," by J. G. Holmes.

LIVERPOOL.—Exchange Hotel, 6.45 for 7 p.m. E.C.A. Liverpool Branch. Annual dinner.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. Informal lecture on "Colour Television," by C. J. Hirsch.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. Junior Institution of Engineers, North-Western Section. "Developments and Future Possibilities in Electricity Generation," by Sir John Hacking (president).

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "The Kemano Hydro-Electric Development and Associated Kitimat Aluminium-Reduction Works," by F. L. Lawton.

Monday, 22nd March, to Friday, 26th March

LONDON.—Old and New Horticultural Halls, S.W.1. Factory Equipment Exhibition.

Tuesday, 23rd March

BRADFORD.—Technical College, Great Horton Road, 6.30 p.m. I.E.E. North Midland Centre. Discussion on "High Voltage in Theory and Practice," opened by A. R. Rumfitt.

LONDON.—Savoy Place, 6 p.m. I.E.E. Education Discussion Circle. "An Experimental and Theoretical Approach to the Teaching of Electromagnetism using the Rationalized M.K.S. System of Units," by F. A. Meier.

Piccadilly Hotel, W.1, 12.15 for 1 p.m. Electric Light Fittings Association. Annual luncheon.

2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. Descriptions of new lighting installations.

At the Institution of Mechanical Engineers, Storey's Gate, 5.30 p.m. Institute of Fuel, London Section. "Solar Energy for Water and Space Heating," by Dr. H. Heywood.

85, Minories, E.C.3, 5.30 p.m. Institute of Marine Engineers. Annual general meeting.

MANCHESTER.—Free Trade Hall, 7.30 p.m. I.E.E. North-Western Centre. Faraday Lecture: "Electro-Heat and Prosperity," by O. W. Humphreys.

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. Annual general meeting, followed by "The Development and Application of Nuclear Reactors," by K. V. Moore.

WOLVERHAMPTON.—Wolverhampton and Staffordshire Technical College, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. "Industrial Application of Electronic Instruments," by A. G. Wray.

Tuesday, 23rd March, to Saturday, 10th April

MANCHESTER.—*Daily Dispatch* Brighter Homes Exhibition.

Wednesday, 24th March

BLACKBURN.—Grosvenor Hotel, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. Annual general meeting.

FARNBOROUGH.—R.A.E. Technical College, 7.30 p.m. I.E.E. Southern Centre. "The Royal Festival Hall: Electrical Installation," by J. G. Hunter.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "Arcs and Sparks," by Prof. F. Llewellyn-Jones.

INVERNESS.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre, district meeting. "The Development of Improved Methods of Earthing, with particular reference to the Rural Area of North Scotland," by J. W. Tolmie and A. Mackenzie.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Supply Section. "Cathode-Spot Performance Phases and Control of Mass Transfer in Vapour-Discharge Devices," by Dr. Ing. H. von Bertele.

Waterloo Bridge House, S.E.1, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Informal meeting. "Some Aspects of the Efficiency Engineer's Job," by D. F. Hamilton.

John Adam Street, W.C.2, 2.30 p.m. Royal Society of Arts. "Manufactures, 1754–1954," by Sir Ben Lockspeiser.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. North-Eastern Students' Section. Tees-Side meeting. "Arc Control in High Voltage Air-Break Circuit Breakers," by D. Legg.

WOLVERHAMPTON.—Junior Institution of Engineers, Midland Section. "Some Aspects in the Choice of Electric Motor Control Gear," by J. R. Bell.

Wednesday, 24th March, to Saturday, 24th April

BIRMINGHAM.—Bingley Hall. National Trades and Home Life Exhibition.

Thursday, 25th March

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. Institute of Fuel, Midland Section. "Problems of Boiler Water Treatment at Medium and High Pressures," by C. W. Drane.

LIVERPOOL.—Philharmonic Hall, 6.45 p.m. I.E.E. Mersey and North Wales Centre. Faraday Lecture: "Electro-Heat and Prosperity," by O. W. Humphreys.

Electricity Showroom, Whitechapel, 7 p.m. E.P.E.A. Merseyside Technical Group. "Economy in the Choice of Switchgear," by L. J. Bamber.

9, The Temple, Dale Street, 7 p.m. Institute of Fuel, North-Western Section. Annual general meeting, followed at 7.15 p.m. by short papers.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. "The Kemano Hydro-Electric Development and Associated Kitimat Aluminium-Reduction Works," by F. L. Lawton. (Supply Section paper).

164, Shaftesbury Avenue, W.C.2, 7 p.m. Television Society. "An Industrial Television Channel," by R. J. Boddy and C. D. Cardner.

SHEFFIELD.—Grand Hotel, 7.30 p.m. Incorporated Plant Engineers, Sheffield and District Branch. Annual general meeting.

Friday, 26th March

BIRMINGHAM.—Imperial Hotel, 7.30 p.m Incorporated Plant Engineers, Birmingham Branch. Annual general meeting, followed by "Industrial Electrical Maintenance," by D. Parkes.

BRISTOL.—S.W.E.B. Colston Avenue, 6.15 p.m. I.E.S. Bath and Bristol Centre. "Hospital Lighting," by D. J. Reed.

CHIPPENHAM.—At the canteen of Westinghouse Brake & Signal Company. I.E.E. Bristol Students' Section. University Lecture.

HARROGATE.—Grand Hotel, 7 p.m. I.E.E. North Midland Centre. Annual dinner-dance.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. Annual general meeting. "Engineering Aspects of Glass," by Dr. R. E. Bastick and H. Cooper.

NEWCASTLE-UPON-TYNE.—Old Assembly Rooms, 7 for 7.30 p.m. I.E.E. North-Eastern Centre. Annual dinner and dance.

E.C.A. CONFERENCE

THIS year's conference of the Electrical Contractors' Association and its allied bodies is being held at Harrogate from 31st May to 2nd June and the provisional programme has now been issued. The Council of the Allied Associations meets on the morning of Monday, 31st May and during the day delegates will arrive and register. In the evening the President (Mr. S. L. M. Barlow, Associate I.E.E.) will hold the customary reception at the Royal Hall, and a dance will follow.

A civic welcome at the Royal Hall opens Tuesday's proceedings and after responding for the Associations Mr. Barlow will deliver his presidential address. There will follow a paper by Mr. J. R. Halliwell on "Business Opportunities for Electrical Contractors." There will be no afternoon session or evening function. Arrangements are being made for a visit to Newby Hall with the alternative of a tour of the Yorkshire dales.

The annual general meeting will be held on the Wednesday morning when members will be given an opportunity of raising matters of general interest. A paper by Messrs. A. H. Olson (Courtney-Pope Electrical, Ltd.) and Mr. C. J. Veness on "Lighting Applications" will be presented and discussed in the afternoon and the business proceedings will conclude with the installation of the new president who will give a short address. In the evening a smoking concert and dance will take place at the Royal Hall.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 28th April from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

28797. Telephone Manufacturing Co., Ltd., Terry, R. S. G., and Marriott, F. W.—Electrically operated indicators. 27th October, 1949. (707872.)

1950

3367. Postmaster General.—Electronic valves and similar devices. 6th July, 1951. (708111.)

5309. Parsons Chain Co., Ltd.—Electrical apparatus for the heat treatment of chain links or other metal elements. 18th May, 1951. (707873.)

8185. Postmaster General and Plessey Co., Ltd.—Electronic valves and similar devices. 6th July, 1951. (708112.)

12540. Electric & Musical Industries, Ltd.—Optical-projection systems. 17th May, 1951. (707974.) 12541. Cathode-ray tubes. 21st May, 1951. (707975.)

12792. General Electric Co., Ltd., Dauncey, L. A., and Still, J. E.—Apparatus for use in growing crystals. 22nd May, 1951. (707976.) 12794. Methods of growing crystals. 22nd May, 1951. (707978.)

12793. General Electric Co., Ltd., and Dauncey, L. A.—Methods for use in the growing of crystals. 22nd May, 1951. (707977.)

14736. Standard Telephones & Cables, Ltd.—Mounting arrangements for devices employing semi-conductor rectifiers. 8th June, 1951. Cognate application 20501, 18th August, 1950. (708054.)

16898. International Business Machines Corporation.—Gaseous electric discharge tube. 6th July, 1950. (708114.)

21497. Kelvin & Hughes, Ltd., and Gibbs, A.—Electrical control systems incorporating vacuum discharge tubes. 30th November, 1951. (708115.)

21957. Automatic Electric Laboratories, Inc.—Voltage stabilizing systems. 6th September, 1950. (707878.)

1951

2663. International Aeradio, Ltd., and Forsyth-Grant, M. I.—Radio communication systems and apparatus. 18th January, 1952. (708064.)

3752. Edison Swan Electric Co., Ltd.—Electric switches. 15th February, 1952. (708185.)

6064. Siemens-Schuckertwerke Akt.-Ges.—Electric switching installations. 13th March, 1951. (707895.)

6982. International Business Machines Corporation.—Gaseous-electric discharge tube. 22nd March, 1951. (708119.)

7975. British Broadcasting Corporation.—Television cameras. 7th April, 1952. (708067.)

8991. Philips Electrical Industries, Ltd.—Inductance coils comprising a ferro-magnetic core of highly permeable ferrite. 17th April, 1951. (708121.) 22580. 27th September, 1951. Addition to 708121. (708140.)

9390. Reyrolle & Co., Ltd., A.—Spring-closed electric circuit breakers. 23rd April, 1952. (708191.)

11274. Parsons, Ltd., C. H., and Handley, G. B.—Electric plug-and-socket couplings incorporating switches. 7th May, 1952. (708003.)

12513. Siemens & Halske Akt.-Ges.—Electron-optical apparatus. 28th May, 1951. (708004.)

12570. British Insulated Callender's Cables, Ltd.—Mechanism for producing or controlling the longitudinal movement of electric cables and tubes during manufacture and for other purposes. 18th April, 1952. (707905.)

12983. Holophane, Ltd., and Holmes, J. G.—Lanterns. 21st January, 1952. (708005.)

13552. General Electric Co., Ltd., and Robson, R.—Belt conveyors. 1st July, 1952. (707907.)

15425. General Electric Co., Ltd., and Briscomb, D. W.—Electric artificial delay networks. 17th June, 1952. (708012.)

16090. English Electric Co., Ltd.—Automatic speed control systems for electric motors. 20th June, 1952. (708075.)

16532. Philips Electrical Industries, Ltd.—Non-metallic permanent magnet materials. 12th July, 1951. (708127.)

17509. Standard Telephones & Cables, Ltd.—Sound distribution systems. 24th July, 1951. (708128.)

19856. Eastman Kodak Co.—Apparatus for translating electric signals into legible characters. 23rd August, 1951. (708016.)

20136/8. Philips Electrical Industries, Ltd.—Devices comprising a magnetic circuit of highly permeable material. 27th August, 1951. (708131/3.) 20139/40. Magnetic bodies comprising a highly permeable part and a thin permanent magnet. 27th August, 1951. (Addition to 708132.) (708134/5.) 20141. Magnetic circuits comprising a highly permeable part and a substantially flat, thin permanent magnet. 27th August, 1951. (708136.)

20142. Philips Electrical Industries, Ltd.—Cathode-ray tube. 27th August, 1951. (708137.)

21795. British Thomson-Houston Co., Ltd.—Electrical insulating material. 17th September, 1951. (708019.)

22462. Dorman & Smith, Ltd.—Mounting of the movable contacts of electric switches. 22nd December, 1952. (707917.)

22979. General Electric Co., Ltd., and Briscomb, D. W.—High-power electric pulse generators. 18th September, 1952. (708021.)

23915. Bamag-Meguin Akt.-Ges.—Electrolytic cells. 15th October, 1951. (708023.)

26368. Padmore, N. T.—Electric indicating apparatus. 10th November, 1952. (708145.)

29630. Hazeltine Corporation.—Colour-television signal-translating system. 18th December, 1951. (708088.)

1952

1543. Soc. Financiere d'Expansion Commerciale et Industrielle Soc. Anon. Sfindex.—Apparatus for the removal or discharge of electrostatic charges from the surfaces of materials of poor electrical conductivity. 18th January, 1952. (707933.)

6366. Peterson, T. F.—Connecting means for glow lamps and like electrical devices. 12th March, 1952. (708209.)

11792. British Thomson-Houston Co., Ltd.—Inductor-controlled electrical circuits including electron-discharge devices. 9th May, 1952. (708161.)

12892. Marconi's Wireless Telegraph Co., Ltd.—Thermionic valve amplifiers. 5th February, 1953. (708105.)

14613. Telefonaktiebolaget L. M. Ericsson.—Device for synchronizing a receiver to the transmitter in a time division multiplex signalling system. 10th June, 1952. (708212.)

15386. Edison Swan Electric Co., Ltd.—Electric amplifier circuit arrangements for recurring sweep waveforms. 18th June, 1952. (708214.)

15591. Vaughan, R. C.—Miniature electric motor. 20th February, 1953. (707948.)

15760. British Thomson-Houston Co., Ltd.—Magnetrons. 23rd June, 1952. (708216.)

16393. Mullard Radio Valve Co., Ltd.—Electrical power supplies. 30th June, 1952. (708169.) 16394. Electrical storage circuits comprising electric glow discharge tubes. 30th June, 1952. (708170.)

18380. Automatic Electric Laboratories, Inc.—Telephone systems incorporating bank-position marking in the switching stages. 21st July, 1952. (708045.)

19053. General Electric Co.—Control or indication arrangements responsive to electro-magnetic radiations. 28th July, 1952. (708221.)

22403. Philips Electrical Industries, Ltd.—Circuits for synchronizing an oscillator to a control oscillation. 5th September, 1952. (708225.)

25323. Standard Telephones & Cables, Ltd.—Accelerometers. 9th October, 1952. (708228.)

25608. Rheostatic Co., Ltd.—Thermostats for use with electric immersion heaters. 13th October, 1952. (708229.)

26920. Research Corporation.—Centrifugal gas-cleaning apparatus. 27th October, 1952. (707955.)

27668. Standard Telephones & Cables, Ltd.—Arrangements for indicating the variations of electrical or other physical quantities. 3rd November, 1952. Addition to 688599. (708110.)

29085. Allmanna Svenska Elektriska Aktiebolaget.—Device independent of voltage variations for indicating radiation energy. 18th November, 1952. (708233.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 24th March:—

DELCO (design). No. 714,259, Class 9. Batteries, switches, switchboards, vacuum cleaners, flat irons, transformers, condensers, coils and holders, arc boxes, relays, armatures, voltage regulators, rectifiers, regulators, conductors, circuit breakers and closers, cables, connections, contact devices, distribution boxes, signalling devices, resistances and fuses; radio apparatus and parts not included in other classes; control apparatus for electric motors; motors.—General Motors Corporation, Detroit, U.S.A. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, W.C.2.

WETROK. No. 719,422, Class 9. Vacuum cleaners and floor polishing machines, etc., all being electrically operated and all for domestic use.—Müller-Brütsch & Co., Zurich, Switzerland. Address for service, c/o Trade Mark Protection Society, 50, Lincoln's Inn Fields, London, W.C.2.

STERTEL. No. 720,930, Class 9. Insulated electric cables.—Sterling Cable Co., Ltd., Sterling Works, Aldermaston, Berks.

MECO (design). No. 722,942 and MECO, No. 722,947, Class 9. Electrical cut-outs, contacts, terminals, switches, respirators, etc.—Mining Engineering Co., Ltd., Meco Works, Bromyard, Worcester.

INTERNEON. No. 723,082, Class 9. Neon electric signs, switching apparatus for use therewith and parts included in Class 9.—Bush Signs, Ltd., 7, Upper Market Street, Hove, Sussex.

No. 724,691 (design). Class 9. Radio, television, photographic and cinematographic apparatus and instruments, etc.—Alfred Read, 34, Cavendish Road, St. Annes-on-Sea, Lancs.

CRAYONNE. No. 725,752, Class 9. Scientific, nautical, surveying and electrical apparatus and instruments, all included in Class 9; radio sets (sold complete); etc.—Crayonne, Ltd., St. Bernard Works, Bexley, Kent.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — SYDNEY. — 10th June. County Council. Equipment for centralized control of consumer loading and street lighting. (E.S.B. 6056/54. Ten/8587.)*

BRISBANE.—19th May. State Electricity Commission of Queensland. 11 kV, 660 V and 250 V cable. (E.S.B. 5957/54. Ten/8581.)*

Ballymena (Co. Antrim).—26th March. Electrical installation in school meals kitchen, St. Louis Convent High School. A. N. Irens, consulting engineer, Friends Provident Building, 58, Howard Street, Belfast.

Belfast.—7th April. Down County Health Committee. Electrical installation in Cregagh New Clinic. J. McCandless, consulting engineer, 18, Strangford Avenue.

Belgium. — BRUSSELS. — 15th April. Ministry of Defence. Spares for radio transmitters. (E.S.B. 6062/54. Ten/8551.)*

Durham.—County Council. Electrical installations in schools. (See this issue.)

Formosa.—TAIPEI.—5th April. Central Trust of China. Lightning arrestors and equipment. (E.S.B. 6067/54. Ten/8554.)* Insulators and accessories. (E.S.B. 6119/54. Ten/18571.)* Switches, receptacles and plugs. (E.S.B. 6068/54. Ten/8586.)* 6th April. Distribution transformers ranging from 5 kVA to 100 kVA. (E.S.B. 6066/54. Ten/8552.)* 8th April. Cable. (E.S.B. 6098/54. Ten/8565.)* Meters, glass cylinders, arc lamp globes and carbon rods. (E.S.B. 6258/54. Ten/8613.)* Voltmeters and ammeters. (E.S.B. 6069/54. Ten/8575.)*

Gravesend.—29th March. Corporation. Electrical installation at central library. (See this issue.)

India.—DELHI.—29th March. Directorate General of Supplies and Disposals. Cable. (E.S.B. 6093/54. Ten/8570.)*

BANGALORE.—31st March. Stores Purchase Committee, Government of Mysore. Electrolytic copper strips and wires. (E.S.B. 5986/54. Ten/8564.)*

New Zealand.—WELLINGTON. 27th April. Post and Telegraph Department. Mercury contact type relays. (E.S.B. 6593/54. Ten/8625.)*

Pakistan. — KARACHI. — 21st April. Karachi Port Trust. Supply, installation and maintenance for three years of radio intercommunication equipment. (See this issue.)

Richmond (Yorks).—17th April. R.D.C. Electrically operated pumping plant and ejector plant in duplicate for Scorton and Bolton-on-Swale sewerage scheme. A. Brooksbank, consulting engineer, 14, The Exchange, Bradford.

Saudi Arabia.—JEDDA.—Minister of Finance. Substation and distribution equipment for Jedda electricity scheme. (E.S.B. 6289/54. Ten/8561.)*

South Africa.—DURBAN.—26th March. Electricity Department. 2,000 street lighting reflectors. (E.S.B. 5914/54. Ten/8577.)* Twelve 33 kV straight joints. (E.S.B. 5890/54. Ten/8582.)* 2nd April. Electricity meters. (E.S.B. 5913/54. Ten/8542.)*

2nd April. Telephone Department. Telephone cables. (E.S.B. 5921/54. Ten/8543.)*

JOHANNESBURG. 7th April. Stores Department, South African Railways. Electrical conduit (E.S.B. 6495/54. Ten/8612.)*

United States.—DENVER, COLORADO.—U.S. Bureau of Reclamation. 1st April. 725 kVA substation for Chandler power and pumping plant. (E.S.B. 6246/54. Ten/8608.)*

Uruguay.—MONTEVIDEO.—21st April. Usinas Electricas y los Telefonas del Estado. 5 MVA three-phase transformer. (E.S.B. 6563/54. Ten/8627.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Bexley.—Corporation. Recommended. Electrical work at Bexley Grammar School (£5,938).—Troughton & Young.

Brighton.—South East Metropolitan Regional Hospital Board. Wiring and fittings for electric lighting and power installations at the Sussex Maternity Hospital, Brighton (£1,653).—Sayers & Son (Brighton).

London.—L.C.C. Installation of electric passenger lifts at various housing estates (£56,750).—J. & E. Hall. Electrical installation at Adamsrill Primary School (£2,363).—W. M. Grant & Co.

WANDSWORTH.—Borough Council. Recommended. Lighting of Wandsworth Road, Upper Richmond Road, Wandsworth Common (West Side) and Trinity Road: Lanterns and electrical gear (£9,860).—Erecon, Ltd. Columns (£9,904).—North Midlands Engineering Co. Sodium discharge lamps (£1,901).—Philips Electrical.

Newcastle - under - Lyme.—Housing Committee. Electrical installations in houses at Chesterton and Clayton (£2,820).—Speed Electric Service.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—Restoration works at Christ Church (£10,000); P. M. Padmore, architect, Caernarvon.

Bangor.—Technical college (£100,000); Caernarvonshire county architect, County Offices, Caernarvon.

Barnard Castle.—Twelve flats at Staindrop for the R.D.C.; J. Lawton, architect, 45, Galgate.

Berwick.—Crematorium (£17,500); J. Armitage, borough engineer.

Blackburn.—Factory at Simonside for North Western Industrial Estates, Liverpool; Ormrod & Banister, architects, 49, Rodney Street, Liverpool.

Blackpool.—Houses (16), Grange Park estate extension; R. Fielding & Sons, Ltd., Stanhope Road Works.

Boldon Colliery. — Social club (£20,000); W. Dixon & Son, 1, Collingwood Street, Newcastle-on-Tyne.

Bootle.—County secondary school at Glovers Lane, Netherton; Tysons (Contractors), Ltd., Dryden Street, Liverpool.

Border (Cumberland).—Houses (71), Madam Banks, Dalston; Thos. Armstrong, Ltd., South Street, Cockermouth.

Buckinghamshire.—Junior school at Far Bletchley, and extensions to Boys' Grammar School, Lascelles Road, Slough; county architect, County Offices, Aylesbury.

Caernarvon. — Works at Balaclava Road for Thomas & Evans, Ltd.; S. C. Foulkes, architect, Merton Place, Pwllycrochan Avenue, Colwyn Bay.

Carlisle.—Alterations to premises at St. Nicholas Works for Cowans Sheldon & Co., Ltd.; John Laing & Son, Ltd., Dalston Road.

Charminster.—Houses (40), as portion of larger scheme, for Dorchester R.D.C.; F. E. Jay, architect, 58, High West Street, Dorchester.

Chelmsford.—Factory, offices and canteen, Widford estate; C. A. S. (Industrial Developments), Ltd., 7, Drayton Gardens, London, S.W.10.

Chester.—Scheme for new county offices; county architect, County Offices, The Castle, Chester.

Chippenham.—Extensions to industrial premises, Factory Lane; Oxo, Ltd., Waterford Mills.

Consett.—Shops and offices at the junction of Victoria Road and Raglan Street; U.D.C. surveyor.

Coulsdon.—Dwellings (57), Sanderstead Hill and Dale Road; U.D.C. surveyor.

Coventry.—New factory at Broad Lane, for E. S. Playdell; B. Reyner, architect, 5, Manor Road.

Croydon.—Factory and offices, King Henry's Drive; Diac, Ltd., precision engineers, 84a, Sumer Road.

Cumberland.—R.C. secondary modern school at Cleator Moor (£100,000), clinics at Penrith and Whitehaven, additions to Queen Elizabeth Grammar School, Penrith, and alterations to Whitehaven police station and courts; county architect, 15 Portland Square, Carlisle.

Darlington.—Bus station, market, shops and cold store (£36,000); borough architect.

Grantham.—Houses (56) and bungalows (16), Goldsmith Road; borough architect.

Hampshire.—Secondary modern girls' school at Lymington, secondary grammar school at Fareham, junior school at Farnborough, and junior and infants' school at Havant; county architect, The Castle, Winchester.

Keighley.—Extensions to factory for Heaton & Flint, Ltd.; J. B. Bailey & Son, architects, North Street.

Liverpool.—Canteen for Spratts, Ltd., at Longmoor Lane; Gerald Shenstone & Partners, architects, 34, Bloomsbury Way, London, W.C.1.

Hillfoot Hey Secondary School; Ormrod & Banister, architects, 49, Rodney Street. New Heys Secondary Grammar School; H. Thearle, 66, Rodney Street. Toxteth Secondary Technical School; Morter & Dobie, 11, Rumford Street. Cuckoo Lane Secondary Modern School; Weightman & Bullen, 76, Rodney Street.

Extensions to factory for Standard Brands, Ltd.; Huckle & Durkin, architects, 268, Sefton House, Exchange Buildings, Liverpool.

London.—FLEET STREET.—Office block, Serjeants' Inn; Devereux & Davies, architects, 3, Gower Street, W.C.1.

ST. PANCRAS.—Showrooms and offices, Whitfield Street; Asta Models, Ltd., 27, Eastcastle Street, W.1.

Maltby.—R.C. church, Morrell Street; J. H. Langtry-Langton, architect, 8, Oak Mount, Bradford.

Mansfield.—Factory extensions, Duke Street; Carr Fastener Co., Ltd., Nottingham Road, Stapleford.

Newcastle - on - Tyne. — Showrooms, offices and stores, Cross Street, for Grahames, Ltd.; M. Gatoff, architect, 25, Trafalgar Street, Newcastle.

Chest clinic at Queen Elizabeth Hospital, Gateshead, and additions to St. Luke's Hospital, Middlesbrough, for Newcastle Regional Hospital Board, "Dunira," Osborne Road, Newcastle-on-Tyne; P. H. Knighton, chief architect.

Ormskirk.—Cinema, Alt Park estate; A. Ernest Shennan, architect, North House, North John Street, Liverpool.

Prudhoe (Northumberland). — Houses (105), at West Wylam and three shops on the Oaklands estate for the U.D.C.; J. M. Angus, architect, 21, Lovaine Place, Newcastle-on-Tyne.

Salisbury.—Secondary modern school, Bemerton Heath; county architect, County Hall, Trowbridge.

Scunthorpe.—Factory and offices; N. Corah & Sons, Ltd., St. Margarets Works, Leicester.

Sheffield.—Five-storey building at Angel Street, for Yorkshire Insurance Co., Ltd.; Hadfield, Cawkwell & Davidson, architects, 279, Glossop Road, Sheffield.

South Bank-on-Tees.—Proposed hotel for Vaux and Associated Breweries, Ltd., The Brewery, Sunderland (£16,000); own architects.

South Shields.—Conversion of Whiteleas Hospital into aged people's home (£16,000); borough engineer.

Sunderland.—Health centre at Springwell (£50,000); borough architect, Grange House, Stockton Road.

Swansea.—Three-storey public health laboratory; Humphrey H. Goldsmith, architect, 18, Gay Street, Bath.

Todmorden.—Mill extension; Charles Crabtree, Ltd., Ferney Mill.

Tynemouth.—Church and parish hall, Lynn Road, for St. Peter's Church Council; G. E. Charlewood, architect, 14, Neville Street, Newcastle-on-Tyne.

Wallsend. — Licensed premises, Churchill Street for Ind Coope and Allsopp, Ltd.; firm's northern regional architect, Craig-y-don, Llandudno.

Houses (56), Orde Avenue; borough engineer, Town Hall.

Walsall.—Factory for Gainsborough Handbags, Ltd.; C. C. Gray, architect, 15, Bridge Street.

Weaverham (Northwich). — Mixed secondary modern school; J. G. Kellett, director of education, City Road, Chester.

Wellingborough.—Phase 2 of John Lea Secondary Modern School; Chowns, Ltd., 63, Edinburgh Road, Northampton.

Whitby.—Houses (96), White Leys; U.D.C. surveyor.

Wigan.—R.C. school at Pemberton; Weightman & Bullen, architects, 76, Rodney Street, Liverpool.

Wigston.—Extensions (£120,000) to hosiery factory; A. H. Broughton & Co., Ltd., Wigston, Leics.

Willesden.—Police station house, Willesden Lane; Architect's Department, New Scotland Yard, S.W.1.

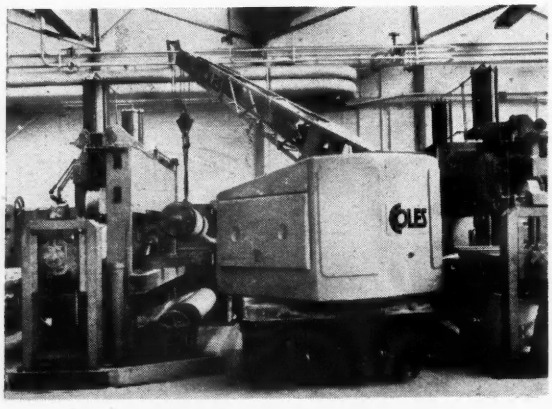
York. — Works extensions; Eclipse Copper Co., boilermakers, Midgley Works, Thomas Street.

Departmental store in Coney Street; British Home Stores, Ltd., 129, Marylebone Road, London, N.W.1.

Battery-Operated Mobile Cranes

TWO battery-operated self-propelled 1 ton capacity mobile cranes newly designed by Steels Engineering Products, Ltd., of Sunderland, are now in service at a recently opened factory in the north-east where heavy duty bushings and other equipment for the electrical industry are produced. Battery-operated models were specified because of fire risk in a factory where paper, fabric, resins, methylated spirit and other highly inflammable materials are used.

Each crane has four motions—hoisting, derricking, slewing and travelling—operated by separate electric motors. These, with the exception of the travel motor mounted on the four-wheeled chassis, are housed in the fully enclosed revolving superstructure, together with the battery and control gear. The hoisting motion is driven by a 1¾ h.p. vertically mounted motor through a worm reduction gear. It is controlled by an electro - magnetic brake and self-resetting limit switches and hoists the maximum load of one ton at a speed of 35 ft/min. A 1¾ h.p. motor, also fitted with an electro-magnetic brake, slews the superstructure in a complete circle in either direction by driving a vertical worm reduction gear through a propeller shaft and a special slipping clutch which prevents the transmission of shocks on starting and stopping. The 80 V 6 h.p. electric travel motor is connected by propeller shaft to the differential with its reversible worm and wheel on the fully floating rear axle.



One ton battery-operated travelling crane at a north-east factory

The battery, 40 Exide-Ironclad cells with a capacity of 192 Ah, is arranged in two 40 V sections. These two halves are connected in parallel for the hoist, derrick and slew motors and for first and second travel speed positions, but for travel positions 3 and 4 they are connected in series to provide 80 V, enabling the travel motor to develop full power. The hoist, derrick and slew motors are wired through the travel controller which disconnects the supply to these motors when third or fourth travel speeds are in use. With an overall length in travelling order of 19ft 6in and a track of 4ft 6in each crane has a clearance height of 8ft 9in with the jib horizontal and a chassis turning circle of 20ft. The approximate unladen weight is 5 tons.